ISA Kit 1.0

User Manual

May 2015

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www.isakit.com

ISA Kit

ISA (Intelligent Sensor and Actuator)™ is an all-in-one educational kit for students and instructors in STEM (Science, Technology, Engineering and Mathematics) programs to learn and teach about sensors (inputs) and actuators (outputs) through interactive hands-on projects.

The technology has been developed at the University of California, Irvine and Intelligent Design Technology, LLC (patent pending). It has been designed, developed, prototyped, and manufactured by Intelligent Design Technology, LLC.

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Key Features of the ISA Kit

- Easy to learn and use
- No soldering or wiring is required
- No pre-knowledge of coding is required (automatically generates C/C++ codes for Arduino-based microcontrollers)
- Compact design to save space
- No requirements for any additional tools or parts
- Cost effective
- Interactive tutorial
- Integrates basic, intermediate, and advanced level projects
- Appropriate for middle school, high school, and college students
- Interactive communication with Windows OS and Android Apps
- Made in the USA

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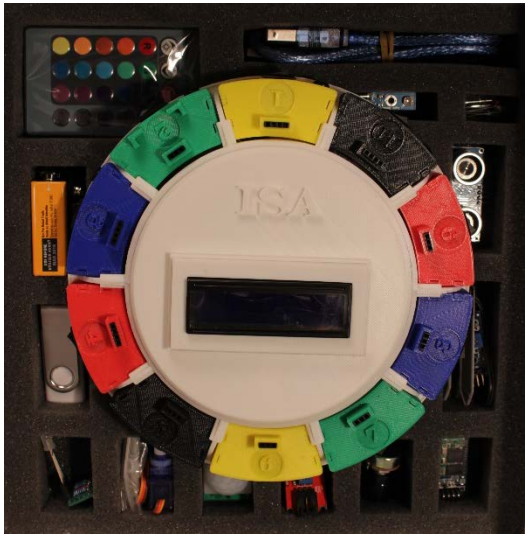
What is Included in the ISA Kit



- One Arduino Mega compatible microcontroller
- One ISA Shield (version 3)
- 10 modules: 7 sensors, 2 actuators, and one Bluetooth
- 10 extension cables
- One infrared (IR) remote control
- LCD display
- Housing and sensor/actuator mounts
- 2GB flash drive
- ISA dashboard (windows-based software)
- ISA kit app for Android smartphone and tablets
- USB cable (to connect ISA kit to your PC)
- 9V to Barrel Jack Adapter + 9V battery (in case you are not using the USB cable)

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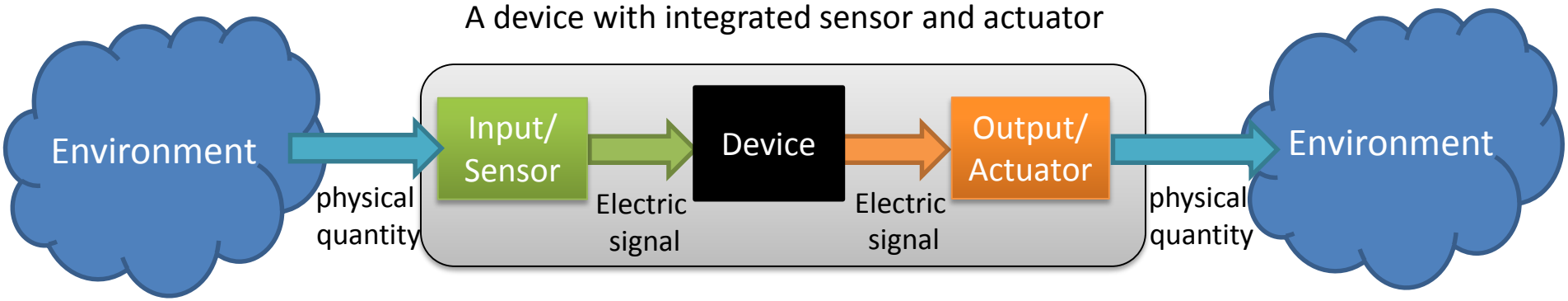
Sensor/Actuator (Input/Output)

Sensor (Input): a converter that measures a physical quantity and converts it into a signal which can be read by an electronic instrument.

Actuator (Output): a type of system (such as a motor) that moves or controls a mechanism or system. It is operated by a source of energy, typically electric current, hydraulic fluid pressure, or pneumatic pressure, and converts that energy into motion.



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Common Sensors and Actuators

Actuator		Sensors							
1	2	3	4	5	6	7	8	9	10
RGB LED	Servo	Soil Moisture	Ultrasonic Rangefinder	Gas & Alcohol	Motion	Infra Red (IR)	Light	Potentiometer	Bluetooth

1. An **RGB LED** (Light-Emitting Diode) is a four-lead light source. By changing the light intensity of red, green, and blue (RGB) components different colors can be formed.
2. A **servomotor** is a rotary actuator so it produces rotary motion and torque. It is used for control of angular position.
3. A **moisture sensor** measures the moisture level of a media such as soil
4. An **ultrasonic sensor** (range finder) determines the distance to an object
5. A **gas sensor** detects level of some common gases such as methane, alcohol, Hydrogen, and smoke.
6. A **motion sensor** detects any motion and moving objects
7. An **infrared (IR) sensor** decodes the signal sent via IR remote controller.
8. A **light sensor** measures the light intensity through a photo cell.
9. A **rotary potentiometer** functions like a knob to increase or decrease a physical quantity such as volume. For example, when used in conjunction with the servo it changes the angle of rotation.
10. A **Bluetooth** transceiver is used to communicate wirelessly with your smartphone or tablet. You can change the LED color or rotate the servo motor.

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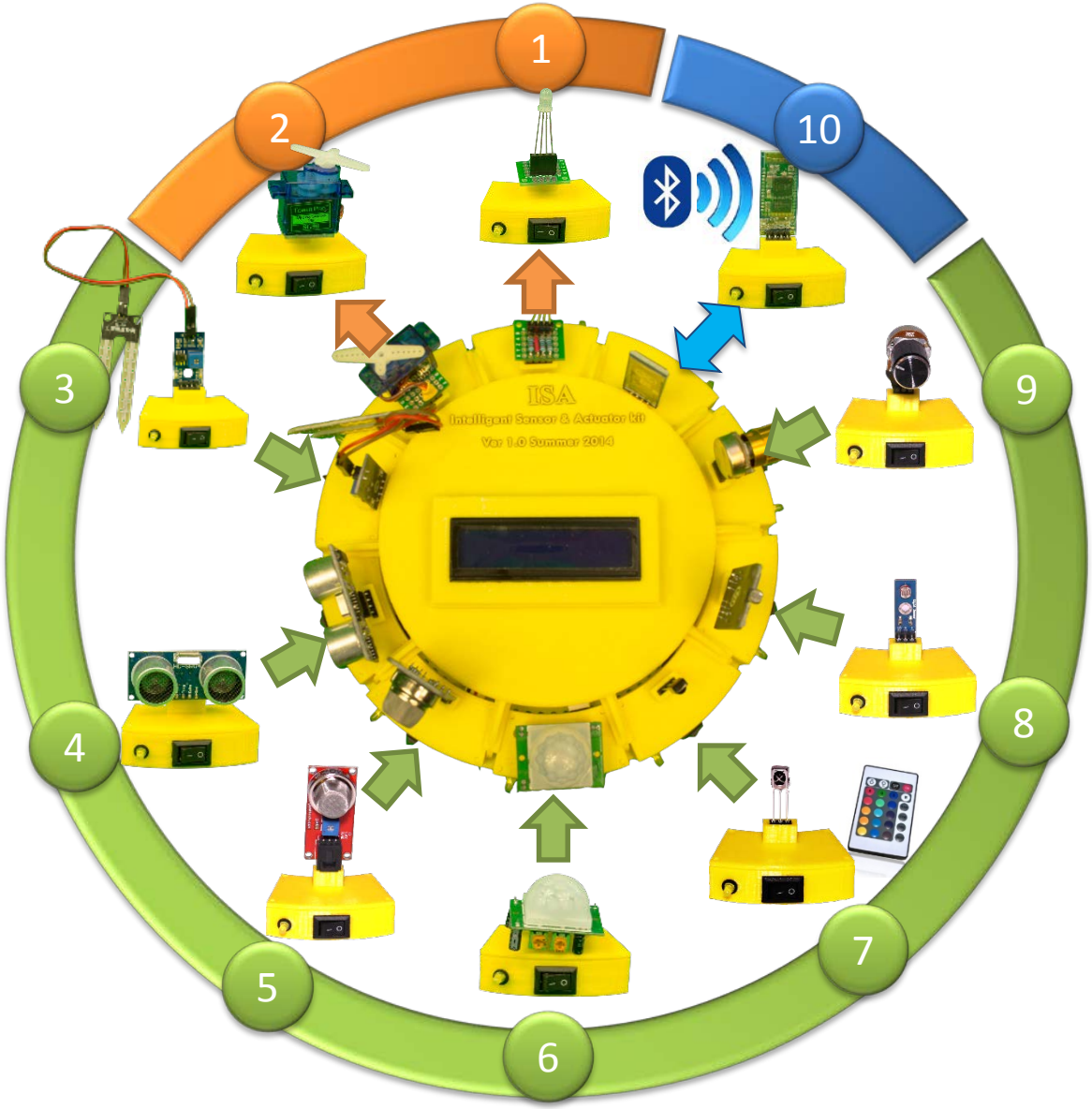
ISA™ Sensors and Actuators



Actuators

1. RGB LED
2. Servomotor

Sensors

3. Moisture
4. Ultrasonic
5. Gas/Alcohol
6. Motion
7. Infrared (IR)
8. Light
9. Potentiometer

10. Bluetooth

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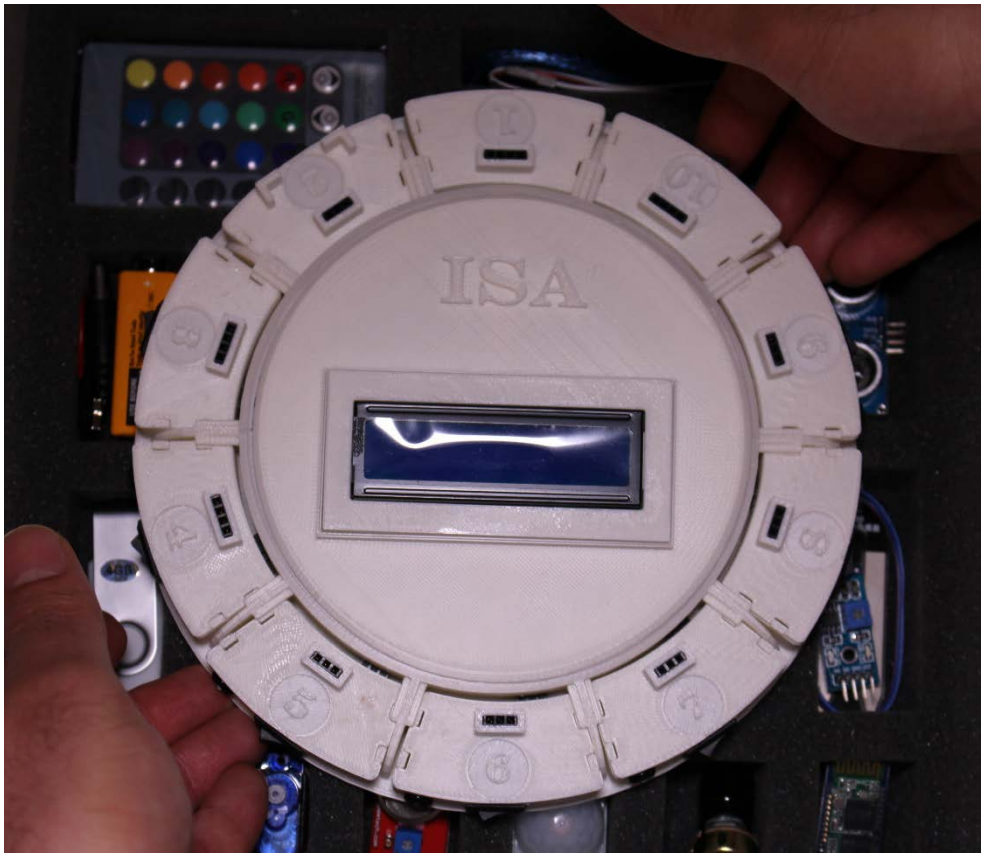
Unpacking the Box



Push your fingers under the housing and lift it up

Watch the video on YouTube

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The ISA Kit Parts

Accessories

- A Remote control
- B USB cable
- C 9V battery
- D Flash drive
- E LED

Actuators

- 1 RGB LED
- 2 Servomotor

Sensors

- 3 Moisture
- 4 Ultrasonic
- 5 Gas/Alcohol
- 6 Motion
- 7 Infrared (IR)
- 8 Light
- 9 Potentiometer

- 10 Bluetooth

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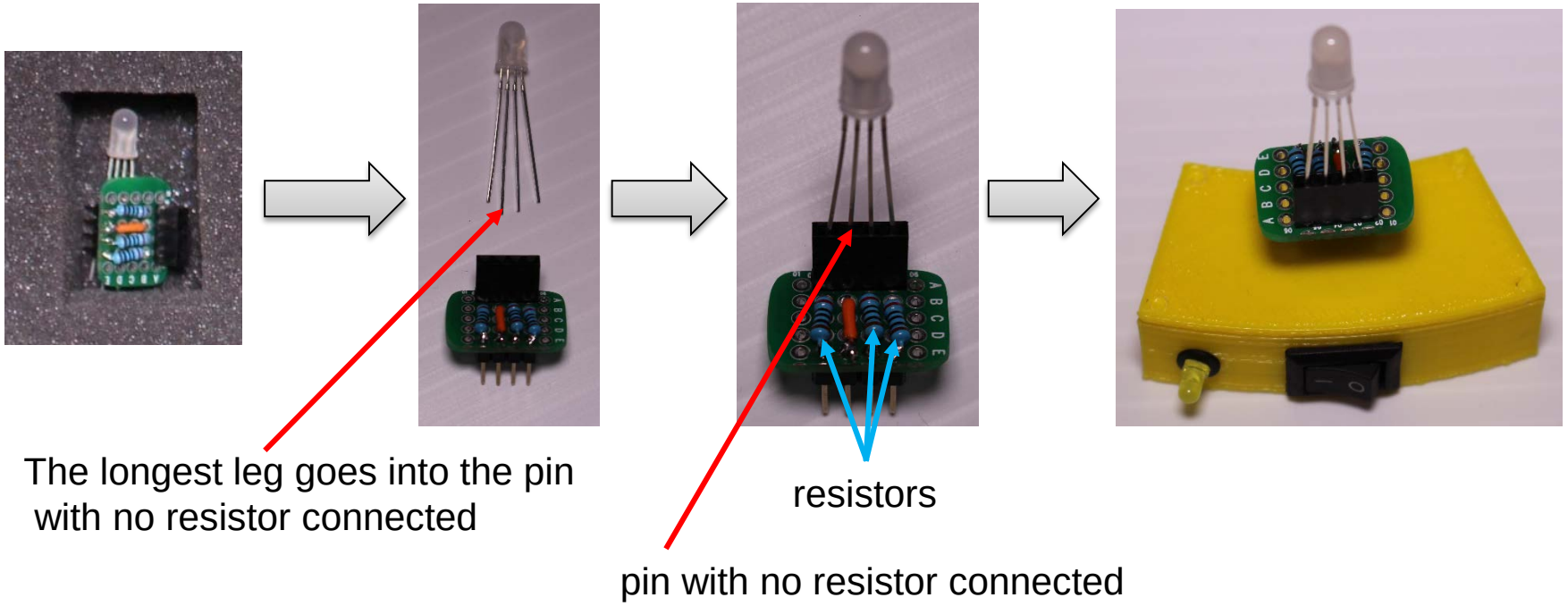
Assemble Module #1

1 **RGB LED:** Insert the RGB LED in the LED holder and then insert it in module box #1 as shown below.



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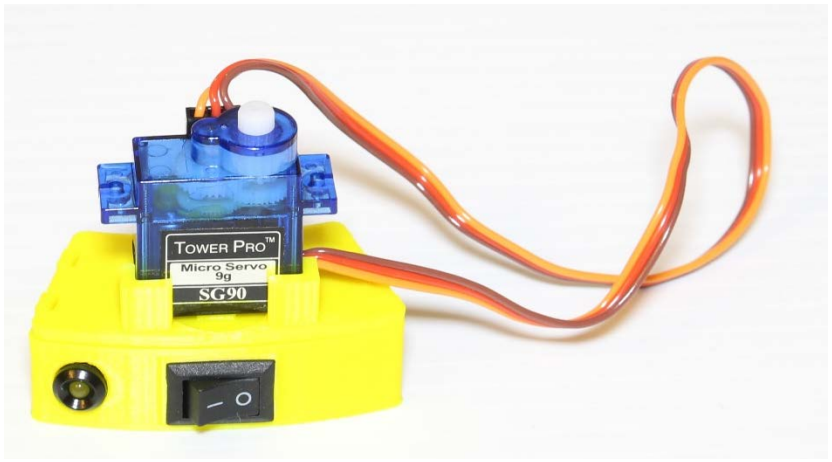
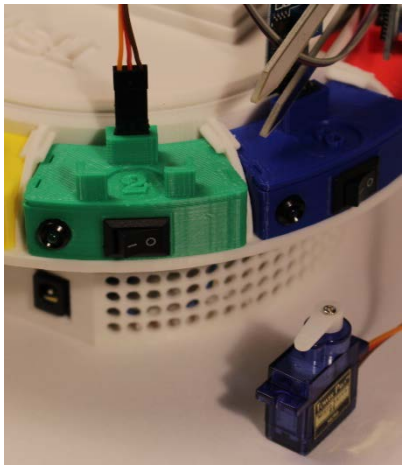
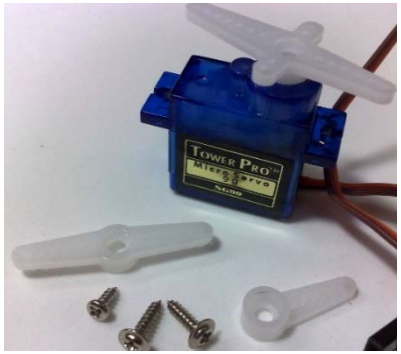
Assemble Module #2

2 **Servomotor:** Connect the wires of servomotor to module box #2 as shown in the picture (brown wire on the right, orange wire on the left). Then mount the servomotor.





Make sure the propeller of the servomotor does not touch the wires while rotating; otherwise, the propeller may damage and cut the wires.



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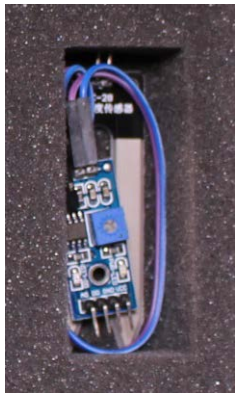
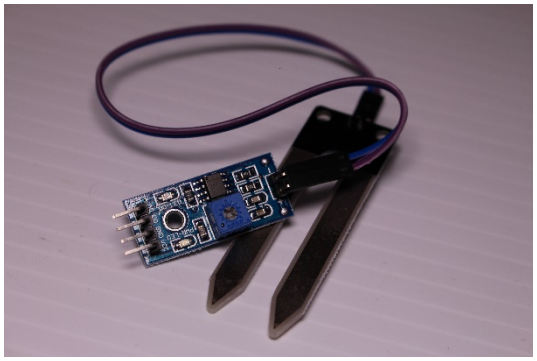
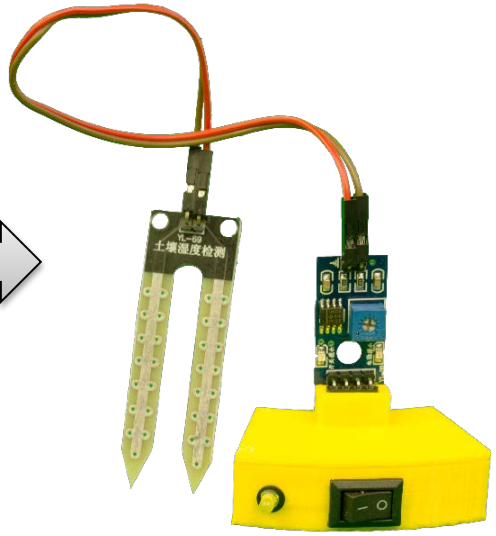
Assemble Modules #3 and #4

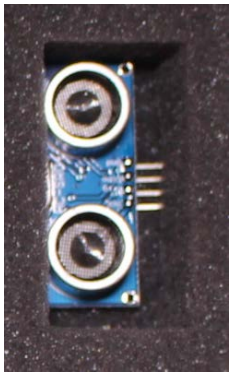
3 **Moisture sensor:** Connect the two parts of the moisture sensor and insert it in module box #3 as shown below.







4 **Ultrasonic sensor**: Insert the ultrasonic sensor in module box #4 as shown below.



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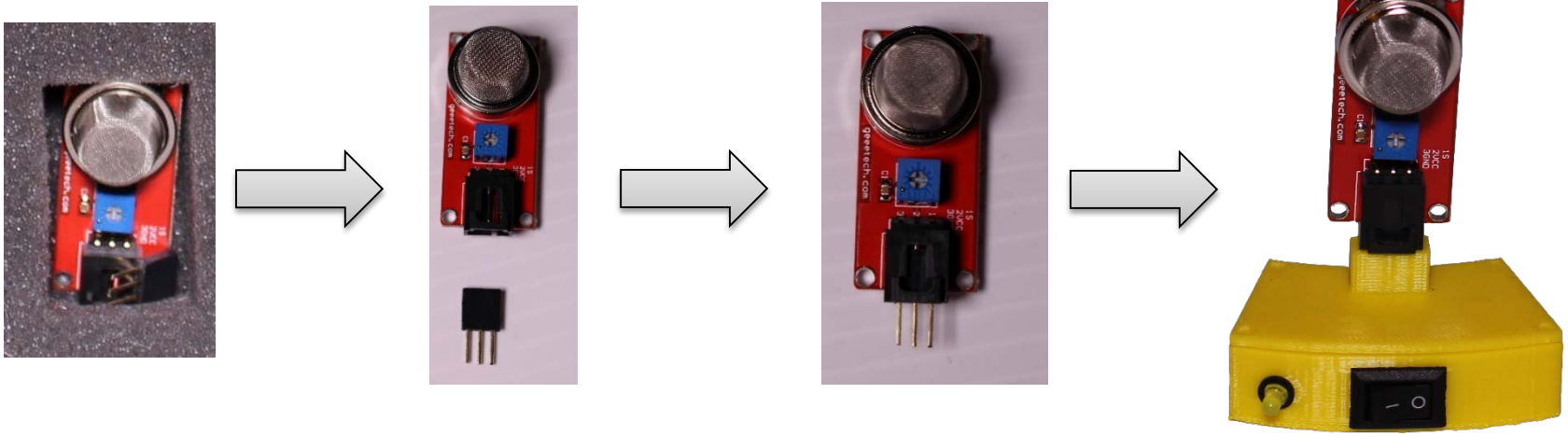
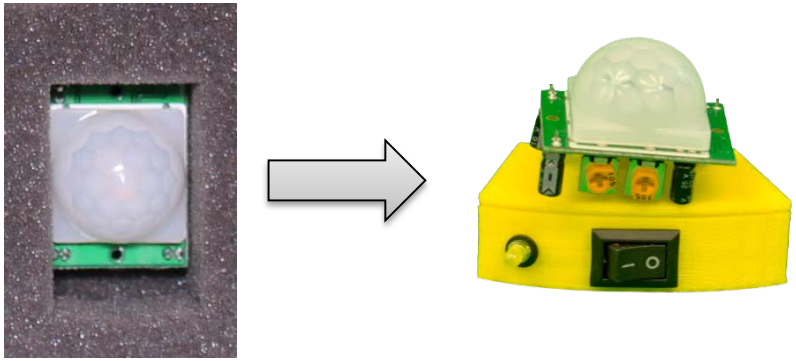
Assemble Modules #5 and #6

5 **Gas/Alcohol sensor:** Insert the female to male extension header and then mount the gas sensor on module box #5 as shown below.



6 **Motion sensor**: Insert the motion sensor in module box #6 as shown below.



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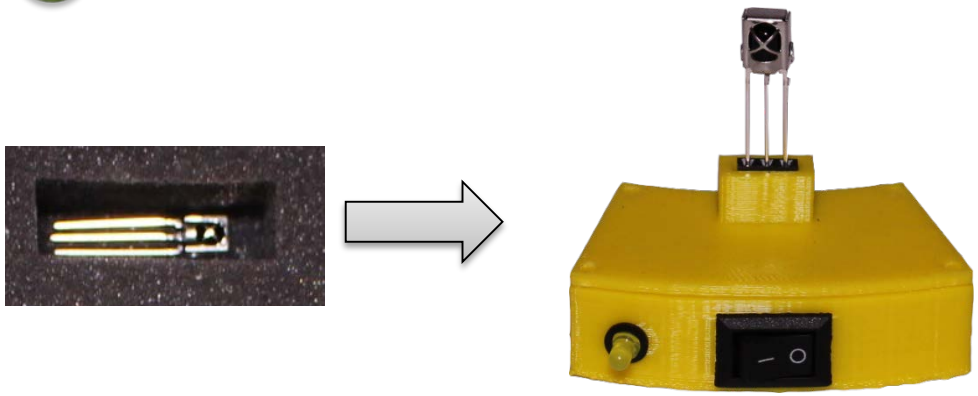
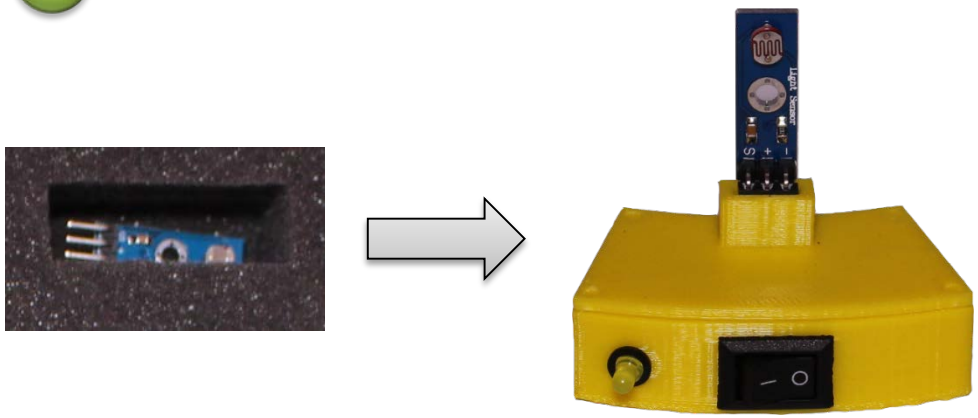
Assemble Modules #7 and #8

7 **Infrared (IR) sensor:** Insert the IR sensor in module box #7 as shown below.



8 **Light sensor**: Insert the light sensor in module box #8 as shown below.



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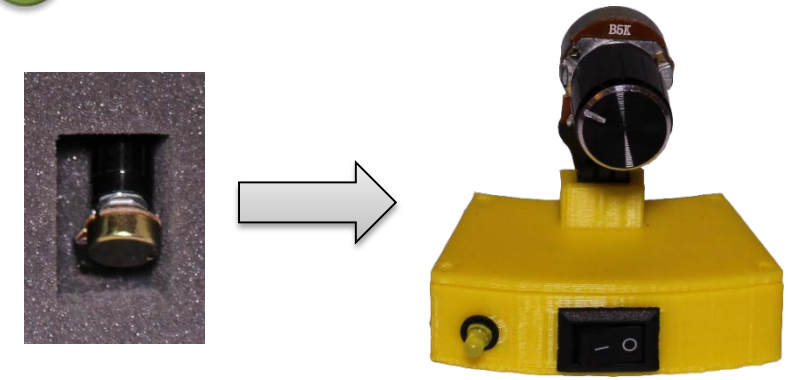
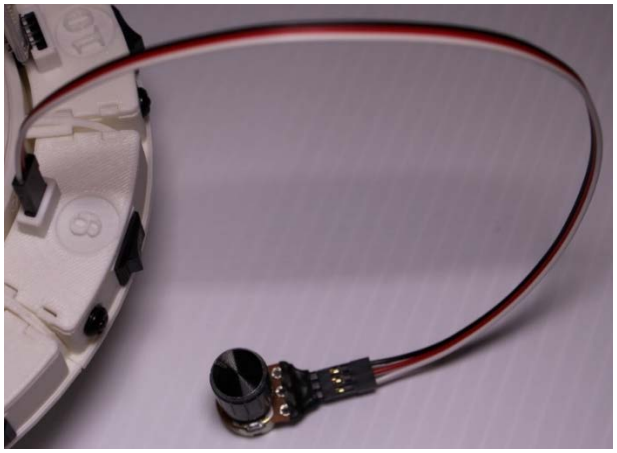
Assemble Module #9

9 **Potentiometer:** Insert the rotary potentiometer in module box #9 as shown below.



Instead of connecting the potentiometer directly to module box #9, you may use an extension cable in between. This way, it will be easier to rotate the knob on the potentiometer and signal noise will be reduced or eliminated.



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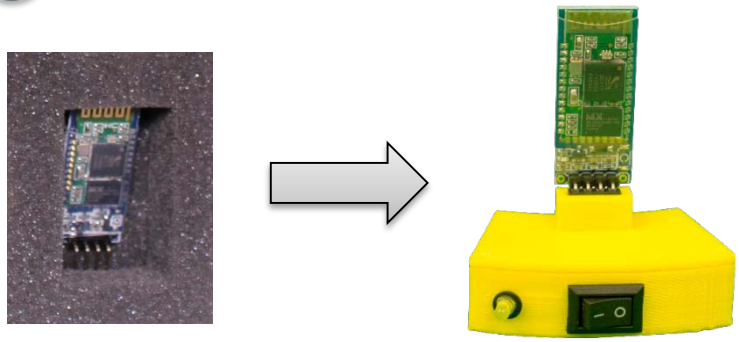
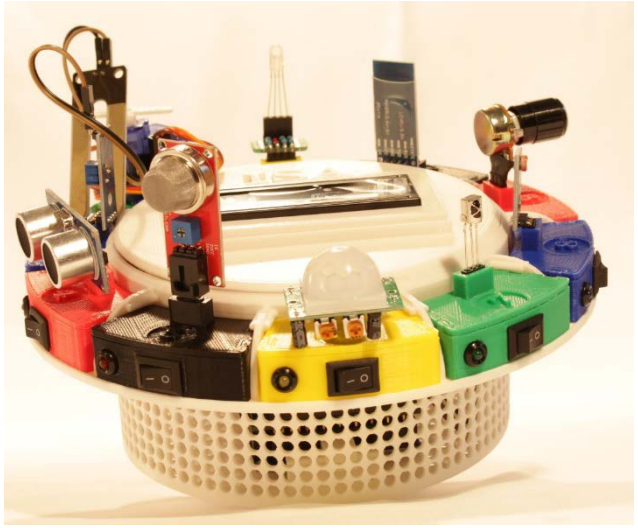
Assemble Module #10

10 **Bluetooth:** Insert the Bluetooth transceiver in module box #10 as shown below.



After connecting all the sensors and actuators, your ISA Kit should look like the following pictures.



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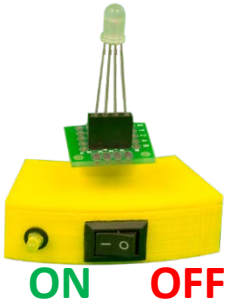
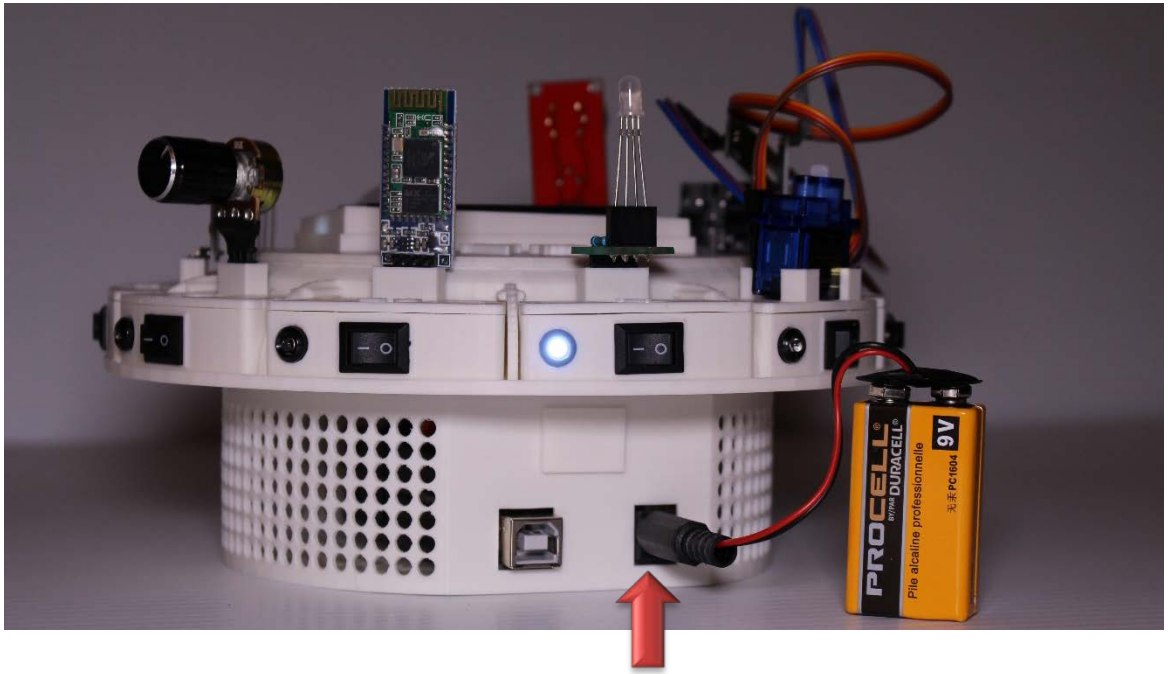
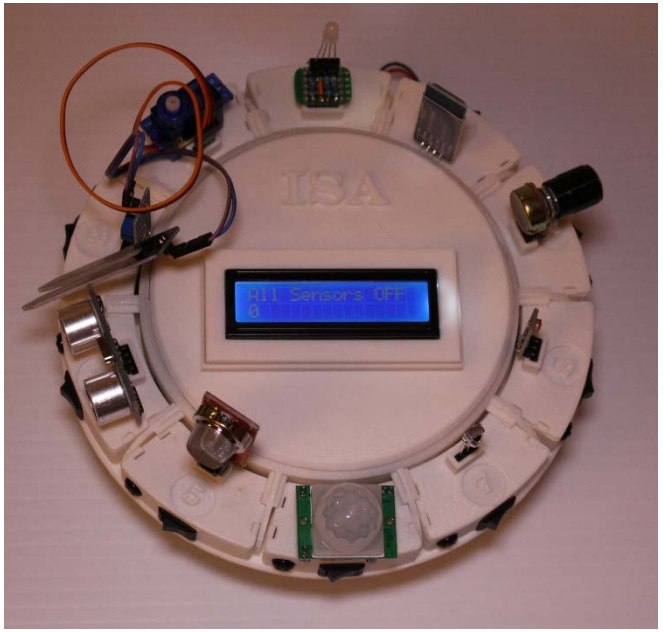
Test the ISA Kit Sensors



After connecting all the sensors and actuators, it is time to test them.
1- Make sure all the switches on the module boxes are in **off** position.
2- Turn on the RGB LED switch (module #1).
3- Connect the 9V battery to the DC power connection in the ISA Kit
4- A couple of welcome messages will be displayed on the LCD and the RGB LED should blink red, green, and blue colors with fading effects.
5- Each module box has an on/off switch. In order to test any sensor you need to turn the switch on. Make sure all the other sensors and actuators are switched off.





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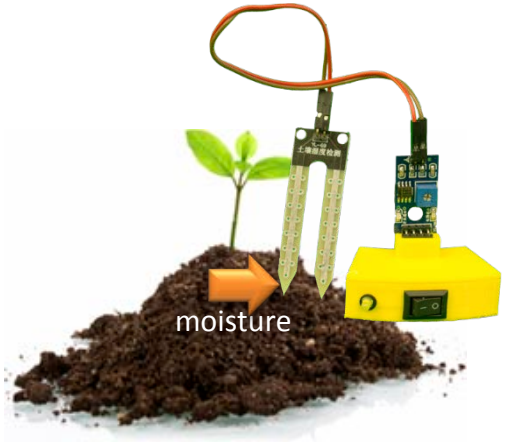
Test the ISA Kit Sensors #3 and #4

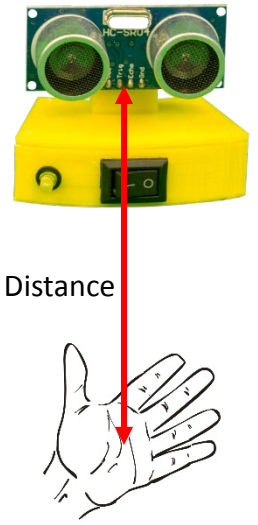
3 Moisture sensor

1. Turn all the switches off.
2. Turn on the switch for module box #3.
3. Measure the moisture of the soil or a wet napkin/cloth. You may also measure the conductivity of your skin by holding the probe of the sensor in you hand and pressing it.
4. The moisture signal will be displayed on the LCD.



4 Ultrasonic Sensor

1. Turn all the switches off.
2. Turn on the switch for module box #4.
3. Move an object backward and forward in front of the ultrasonic sensor.
4. The distance from object will be displayed on the LCD (the unit of measurement is in centimeter).



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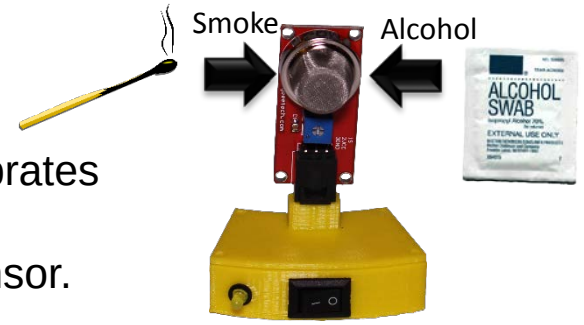
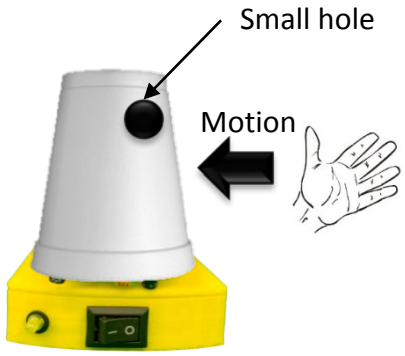
Test the ISA Kit Sensors #5 and #6

5 Alcohol sensor



1. Turn all the switches off.
2. Turn on the switch for module box #5.
3. Wait for a few seconds (~ 20 seconds) until the sensor calibrates itself.
4. Use smoke from a match or alcohol swab in front of the sensor.
5. The level of gas or alcohol will be displayed on the LCD.

6 Motion sensor



1. Turn all the switches off.
2. Turn on the switch for module box #4.
3. Wait for a few seconds then move your hand.
4. This sensor is very sensitive to motion detection so any motion in the vicinity of the sensor will be detected. One way to test the sensor is to use a Styrofoam or opaque plastic cup with a small hole in it. Cover the motion sensor with the cup. Any movement close to the hole will be detected.

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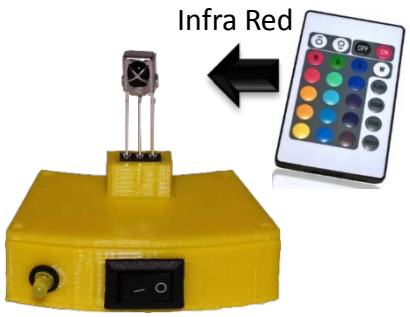
Test the ISA Kit Sensors #7 and #8

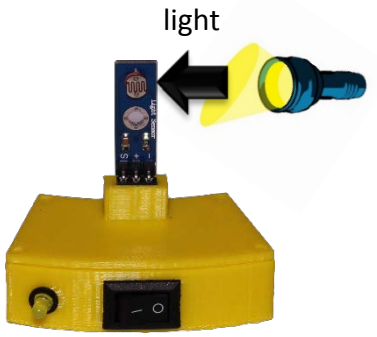
7 IR sensor

1. Turn all the switches off.
2. Turn on the switches for module box #1 (RGB LED) and #7 (IR).
3. Push the buttons on the IR remote control to change the color of RGB LED.
4. At the end, make sure to push the off button to turn the LED off.



8 Light sensor

1. Turn all the switches off.
2. Turn on the switch for module box #8.
3. Change the light intensity using a flash light or by turning the room's light on and off.
4. The level of light intensity will be displayed on the LCD. This is a number between 0 to 100.



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Test the ISA Kit Sensor #9

9 Potentiometer

1. Turn all the switches off.
2. Turn on the switch for module box #9.
3. Turn the knob on the potentiometer.
4. A number between 0 to 1023 will be displayed on the LCD. When you turn the knob clockwise (CW), the value increases and when you turn it counter clockwise (CCW), the value decreased.
5. To test the servomotor (actuator), turn on the switch for module box #2. The servomotor will follow the rotation of the potentiometer.

Make sure the propeller of the servomotor does not touch the wires while rotating; otherwise, the propeller may damage and cut the wires.

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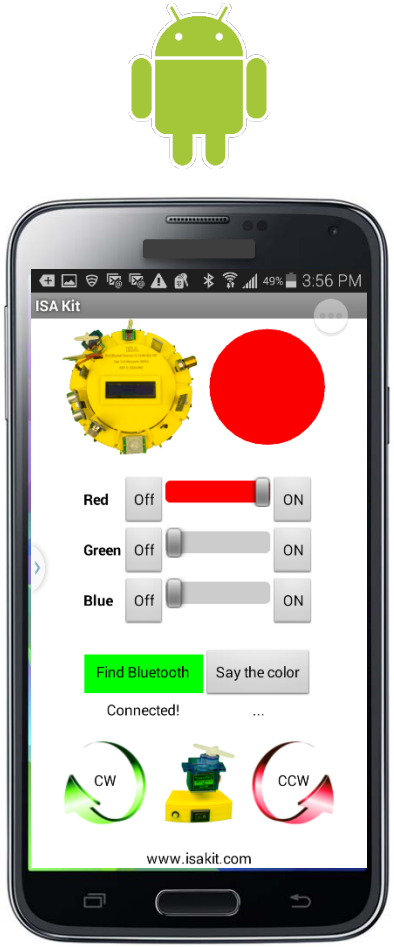
Test the ISA Kit Bluetooth

10 Bluetooth

1. Turn all the switches off.
2. Turn on the switches for module boxes #1 (RGB LED) and #10 (Bluetooth).
3. Run ISA Kit Android app on your smartphone or tablet with Android mobile operating system (OS).
4. Find the ISA Bluetooth and connect to it. The instructions on how to connect to the ISA Bluetooth will follow in the next page.
5. Change the color of RGB LED from the app.
6. You may also control the servomotor and rotate the propeller. To do so, turn on the switch for module box #2 as well.



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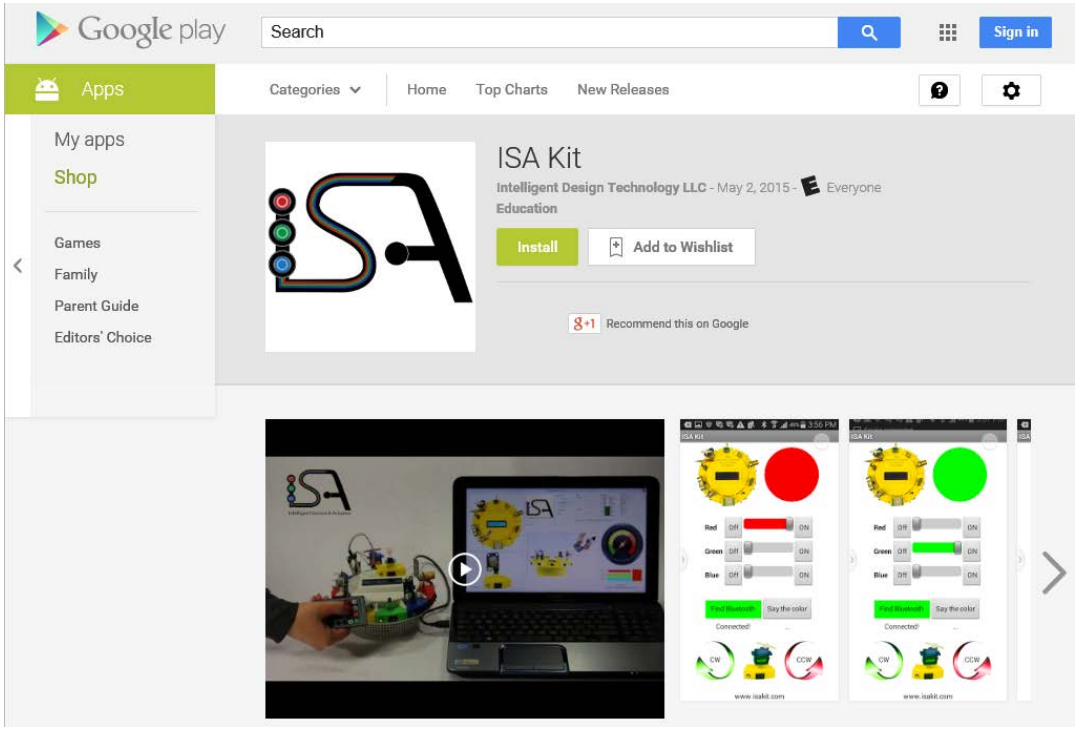
ISA Kit Application: Installing

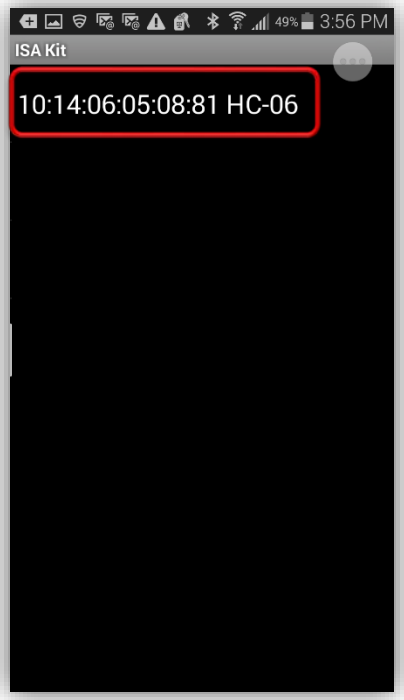
Download and install the ISA Kit Application (App) from Google Play:
Method 1: Search for “isa kit” in Google Play. Keep the quotation marks when doing the search.
Method 2: Scan the following QR code with your smart phone (Android). Then open the URL with Play Store.



ISA Kit Application: Pairing

You need to pair your smartphone to the ISA Kit Bluetooth when connecting to it for the first time:

1. Turn on the Bluetooth on your phone or tablet. Turn on the Bluetooth (module #10) on your ISA Kit. The Bluetooth red LED should be blinking.
2. Scan (search) for Bluetooth devices. The ISA Kit Bluetooth name is “HC-06”. Select it. If asked for password, enter “1234” or “0000”.
3. If you do not see HC-06 in the list of nearby devices you may need to turn off the Bluetooth on your smartphone and ISA Kit and turn them back on then try again.



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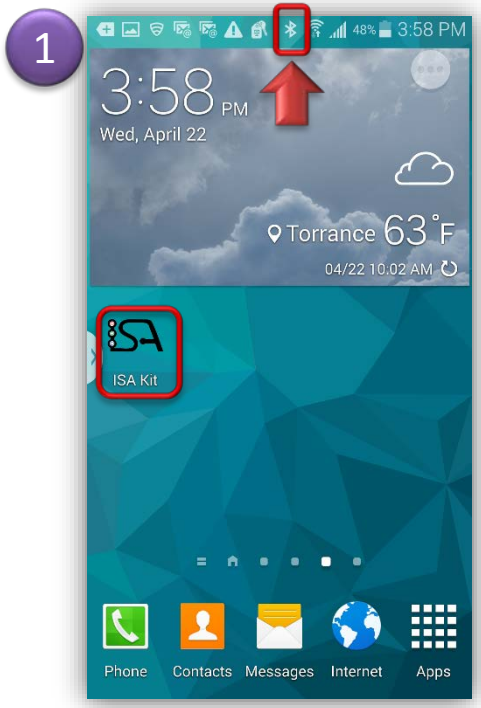
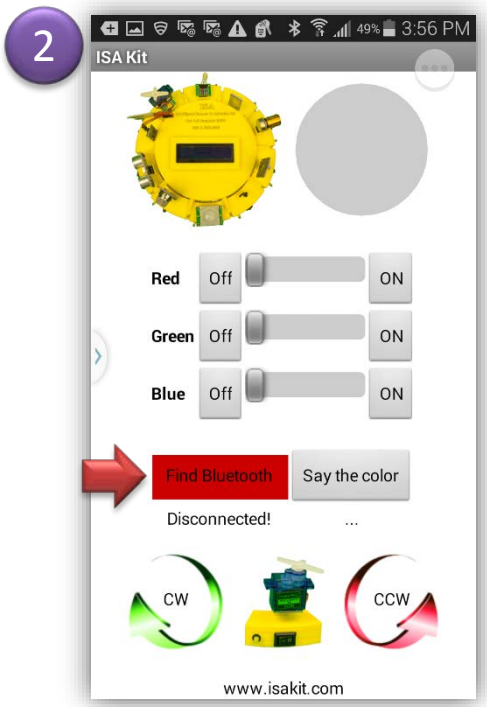
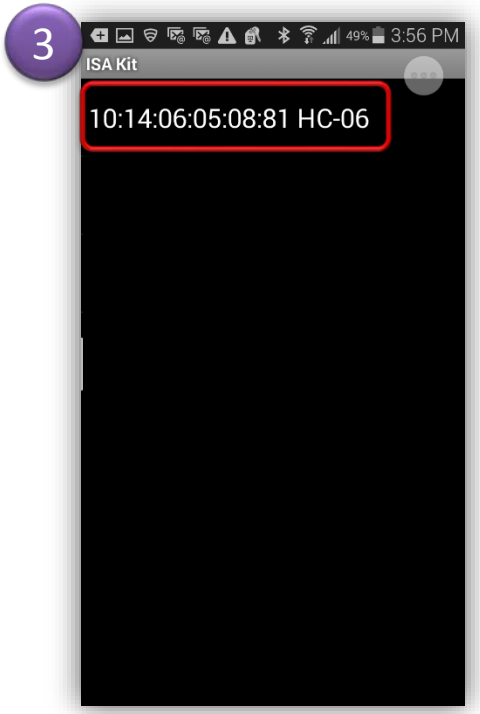
ISA Kit Application

1. Turn on the Bluetooth on your phone or tablet. Turn on the Bluetooth (module #10) on your ISA Kit. The Bluetooth red LED should be blinking. Then run the ISA Kit App.
2. Click on “Find Bluetooth” button on the App.
3. Select “HC-06”. If you do not see HC-06 you need to pair your device with the ISA Kit Bluetooth as instructed in the previous section.







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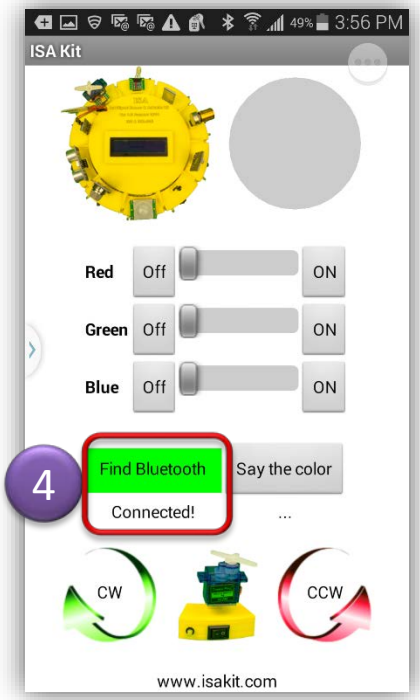
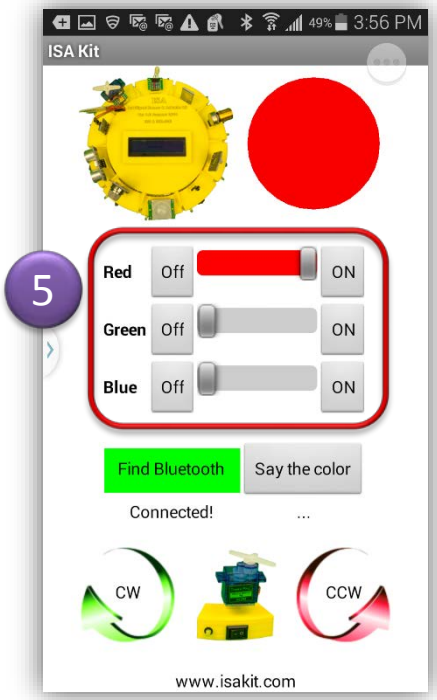
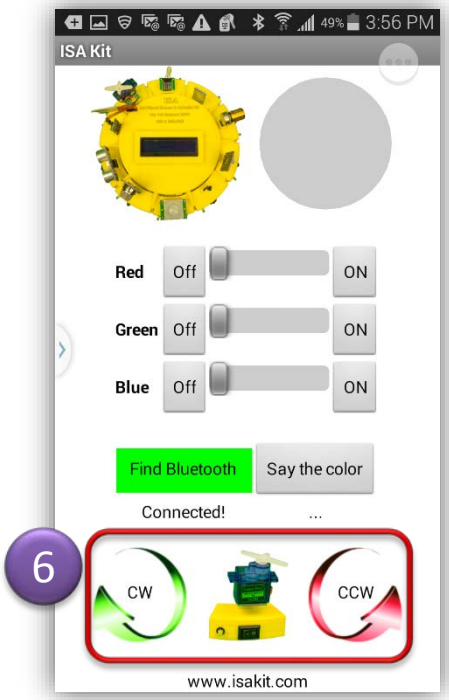
ISA Kit Application (Cont'd)

4. When successfully connected, the button color will change to green and the Bluetooth LED will be solid (not blinking).
5. Now you can change the color of RGB LED (module #1) on your ISA Kit. Simply click on "ON" or "OFF" buttons for each color (Red, Green, and Blue).
6. You can rotate the propeller of the servomotor (module #2) by clicking on CW (clockwise) and CCW (counterclockwise) buttons.

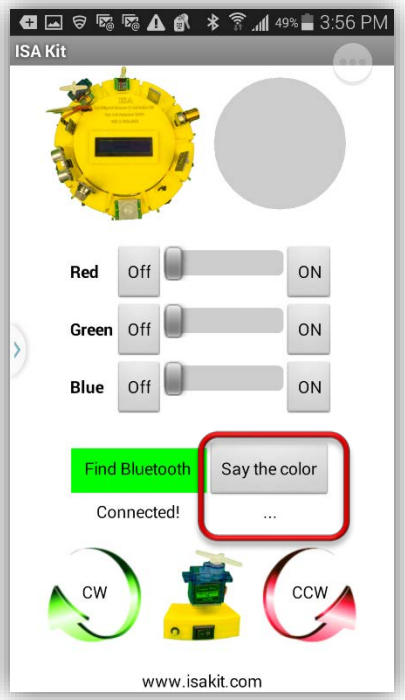


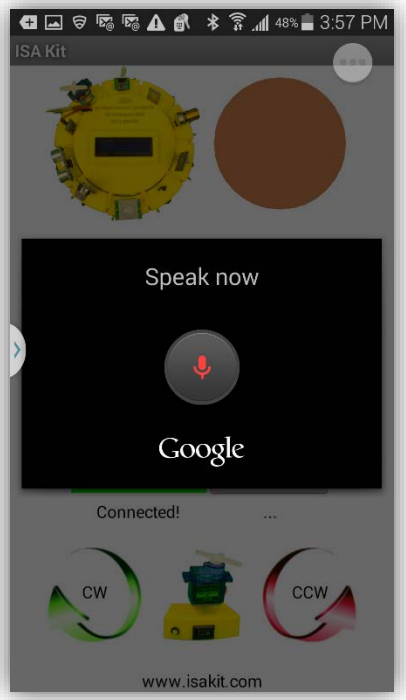




ISA Kit Application (Cont'd)

7. If you click on "Say the color" you can say the color name into the microphone. Main color names are: red, green, blue, yellow, cyan, magenta, purple, pink, orange, brown, black, and white. If you say "random" a random color will be generated. If you say "clockwise" or "counterclockwise" you can rotate the servomotor propeller.
8. If the color or command is not recognized, it will add "!?" in front of the color name.





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Extension Cables

Each sensor and actuator is connected to the ISA Shield through an extension cable. You can pull out the sensors and actuators from their compartments and move them according to the project requirements.

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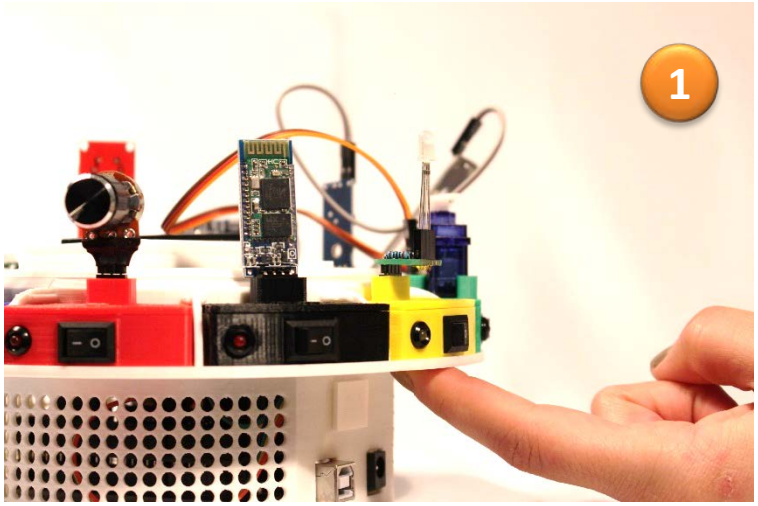
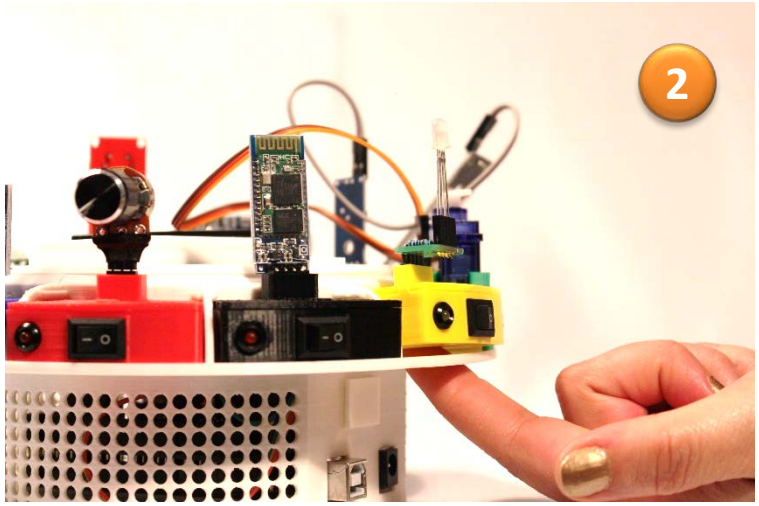
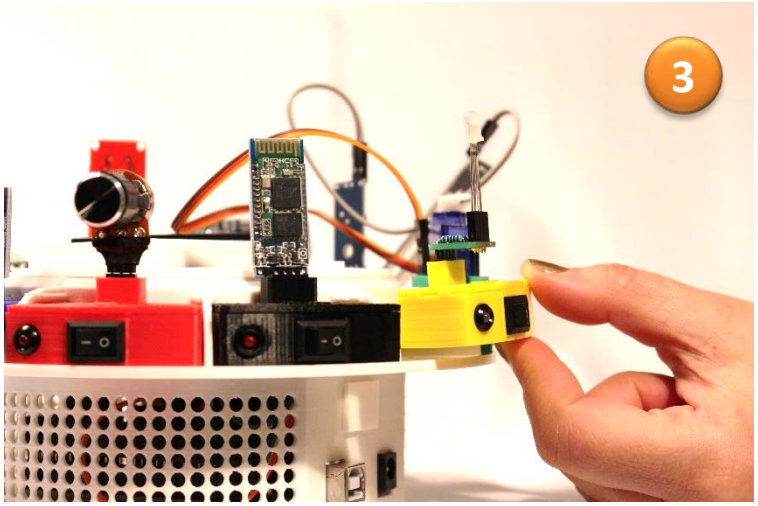
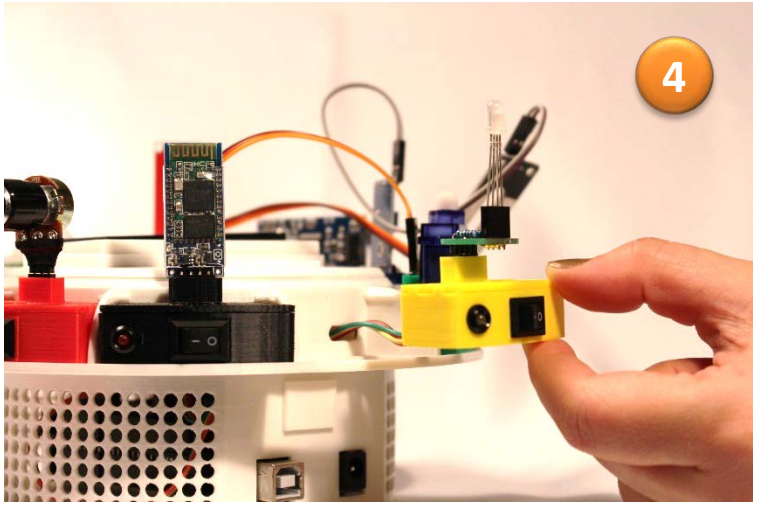
Extension Cables (Cont'd)









Push the sensor mount up then gently pull it out.

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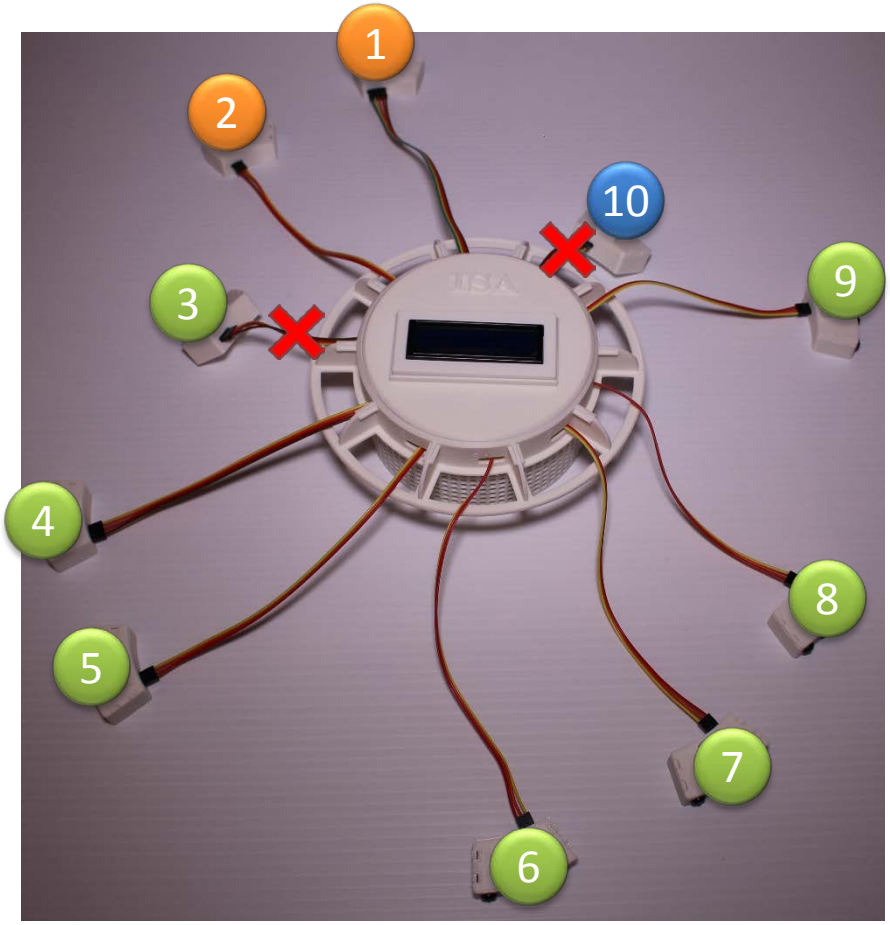
Extension Cables (Cont'd)

Warning!
Do not pull out the extension cables more than 6" (~15 cm).
Do not pull out the Bluetooth (#10) and moisture sensor (#3) module boxes because their extension cables are too short.



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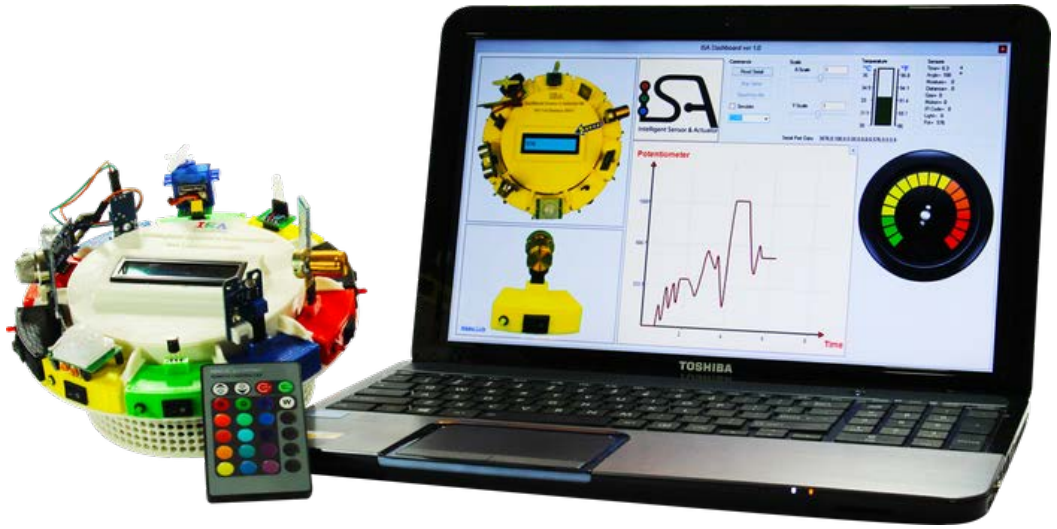
Software

The ISA Kit comes with two software packages:

1. Arduino Integrated Development Environment (IDE) to develop C code and upload it to the Arduino board.
2. ISA Dashboard is a software package developed for the ISA Kit. It provides an interface between the user and sensors/actuators on the ISA Kit. It communicates with the ISA Shield that is mounted on an Arduino microcontroller. The ISA Dashboard gets the signals and displays them on the computer screen via a Graphical User Interface (GUI). It functions similar to an oscilloscope. The ISA Dashboard is compatible with Windows 7, 8, and 8.1 operating systems (OS).



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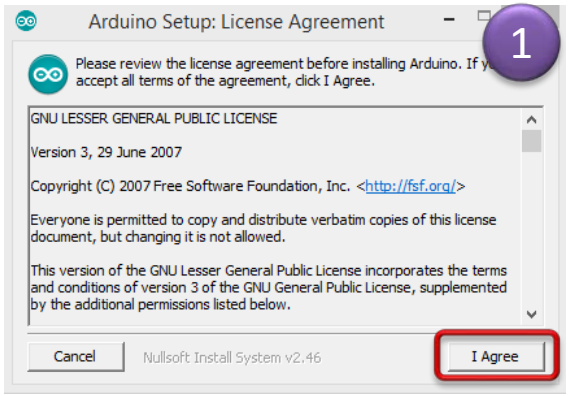
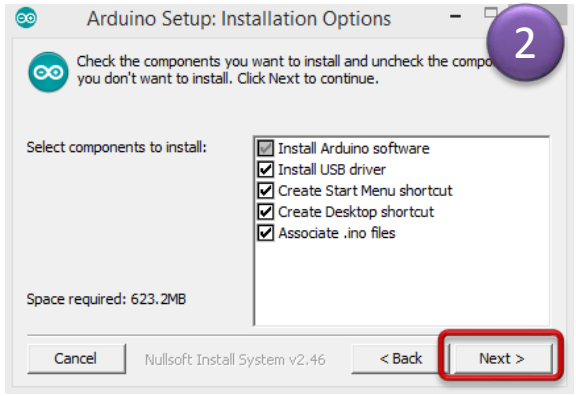
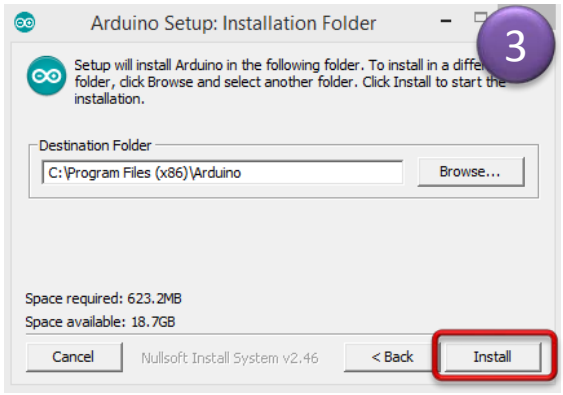
Install Arduino IDE

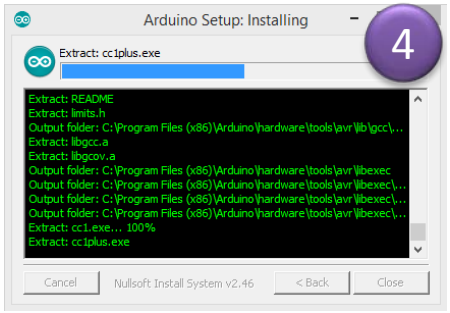
You can install the Arduino Integrated Development Environment (IDE) from the flash drive that comes with your ISA Kit. You may also download the latest version from the following link: http://arduino.cc/en/Main/Software.

The following six steps depict the procedure to install the Arduino (IDE):

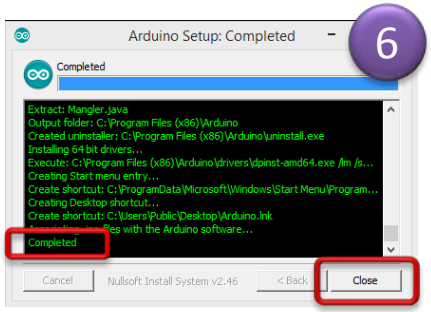

1
Arduino Setup: License Agreement
Please review the license agreement before installing Arduino. If y
accept all terms of the agreement, click I Agree.
GNU LESSER GENERAL PUBLIC LICENSE
Version 3, 29 June 2007
Copyright (C) 2007 Free Software Foundation, Inc. <http://fsf.org/>
Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.
This version of the GNU Lesser General Public License incorporates the terms and conditions of version 3 of the GNU General Public License, supplemented by the additional permissions listed below.
Cancel
Nullsoft Install System v2.46
I Agree


2
Arduino Setup: Installation Options
Check the components you want to install and uncheck the compo
you don't want to install. Click Next to continue.
Select components to install:
Install Arduino software
Install USB driver
Create Start Menu shortcut
Create Desktop shortcut
Associate .ino files
Space required: 623.2MB
Cancel
Nullsoft Install System v2.46
< Back
Next >





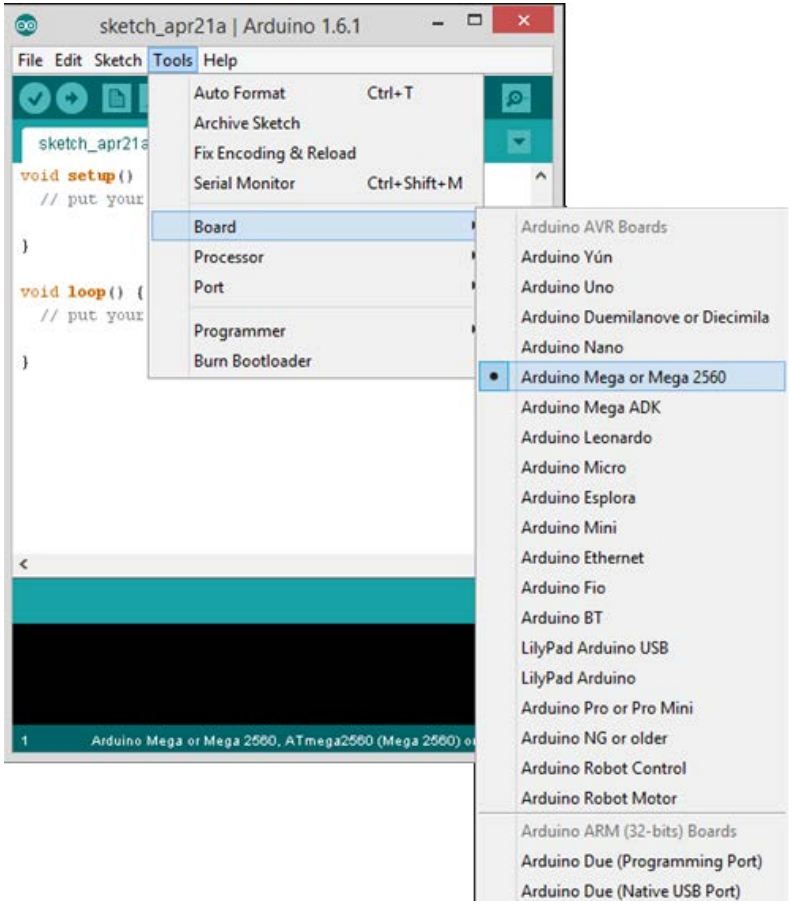
5
Windows Security
Would you like to install this device software?
Name: Arduino USB Driver
Publisher: Arduino LLC
Always trust software from "Arduino LLC".
Install
Don't Install
You should only install driver software from publishers you trust. How can I decide which device software is safe to install?



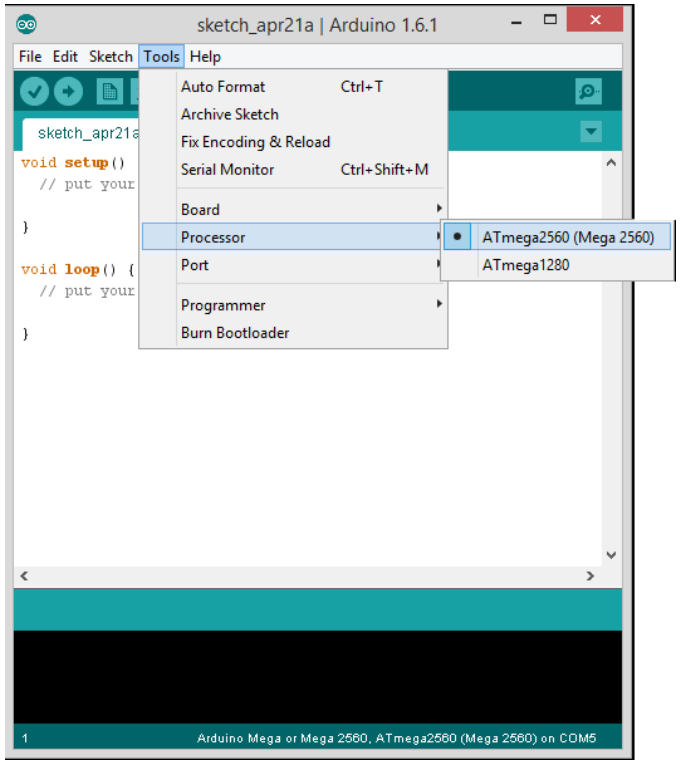
Arduino IDE

After installing the Arduino IDE, you may run it and configure the settings.

Tools→Board→ Arduino Mega or Mega 2560

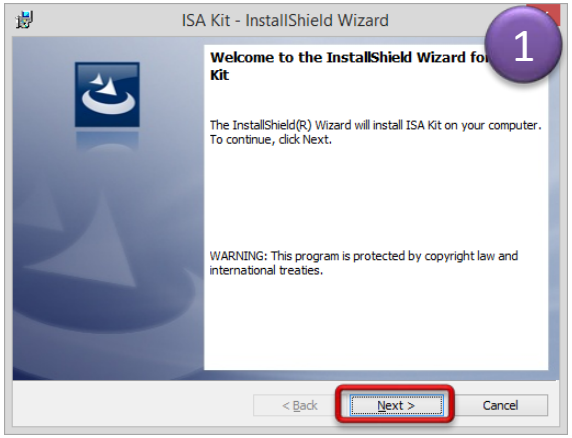


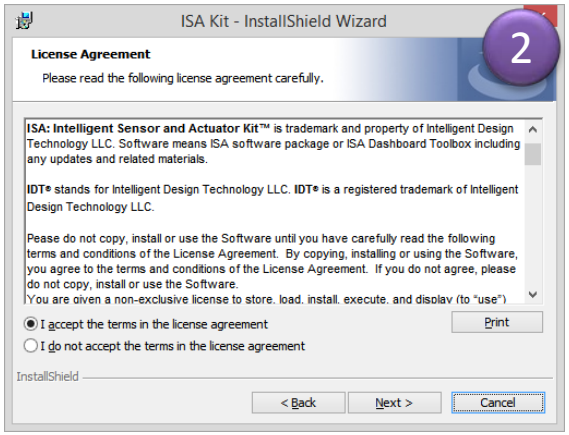
Tools→Processor → ATMega 2560 (Mega 2560)

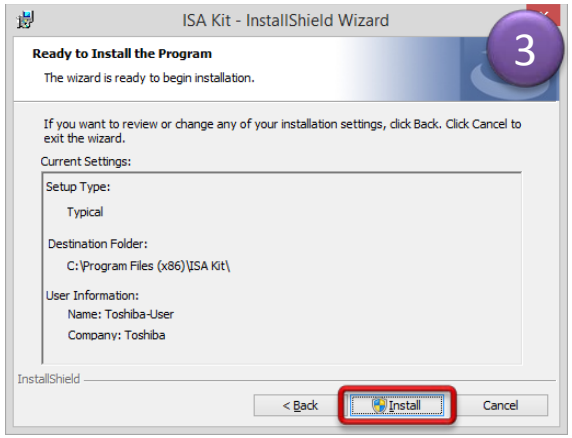


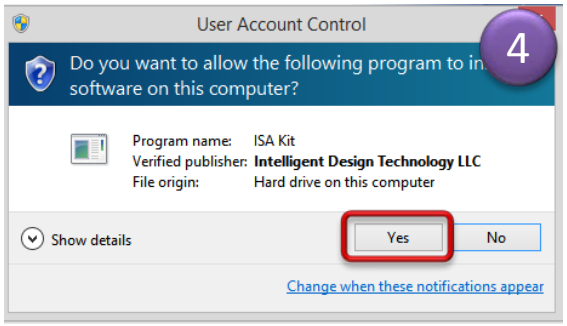
Install ISA Dashboard

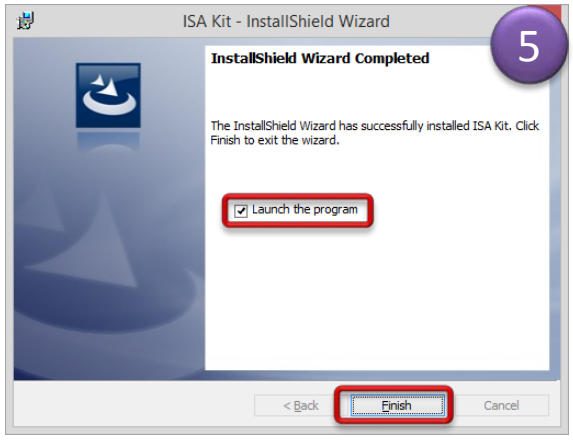
Install the ISA Dashboard Toolbox by running ISAKit_Setup.exe. Install the ISA Dashboard after installing the Arduino IDE. We highly recommend to close all other applications while installing the ISA Dashboard.
The following five steps depict the procedure to install the ISA Dashboard:


ISA Kit - InstallShield Wizard
1
Welcome to the InstallShield Wizard for ISA Kit
The InstallShield(R) Wizard will install ISA Kit on your computer. To continue, click Next.
WARNING: This program is protected by copyright law and international treaties.
< Back
Next >
Cancel


ISA Kit - InstallShield Wizard
2
License Agreement
Please read the following license agreement carefully.
ISA: Intelligent Sensor and Actuator Kit™ is trademark and property of Intelligent Design Technology LLC. Software means ISA software package or ISA Dashboard Toolbox including any updates and related materials.
IDT® stands for Intelligent Design Technology LLC. IDT® is a registered trademark of Intelligent Design Technology LLC.
Pease do not copy, install or use the Software until you have carefully read the following terms and conditions of the License Agreement. By copying, installing or using the Software, you agree to the terms and conditions of the License Agreement. If you do not agree, please do not copy, install or use the Software.
You are given a non-exclusive license to store, load, install, execute, and display (to "use")
I accept the terms in the license agreement
I do not accept the terms in the license agreement
Print
InstallShield
< Back
Next >
Cancel

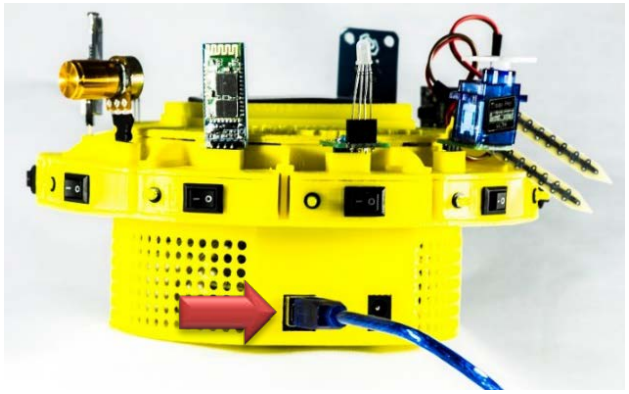



User Account Control
4
Do you want to allow the following program to install software on this computer?
Program name: ISA Kit
Verified publisher: Intelligent Design Technology LLC
File origin: Hard drive on this computer
Show details
Yes
No
Change when these notifications appear

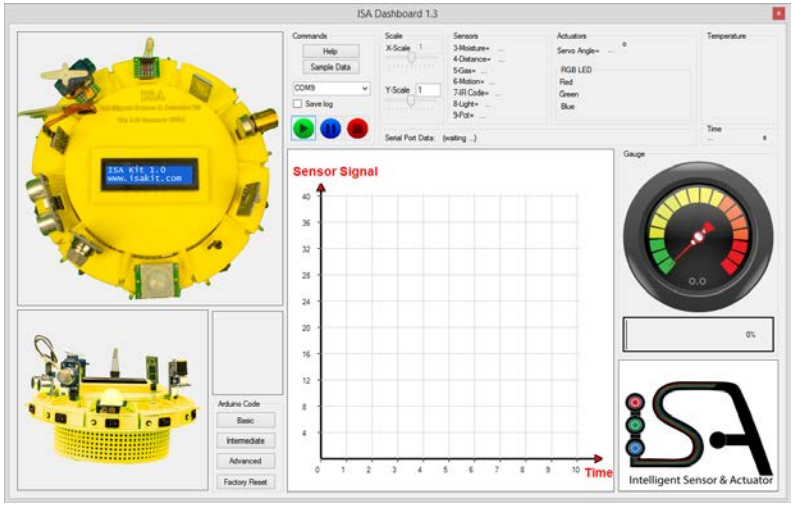


Run the ISA Dashboard

1. Connect the USB cable to the ISA Kit and the USB port of your computer. Make sure the 9V battery is NOT connected.



2. Turn on RGB LED (module #1) and servomotor (module#2). The run ISA dashboard by clicking on the ISAKit.exe shortcut ( ) on your desktop or from Windows Start menu.



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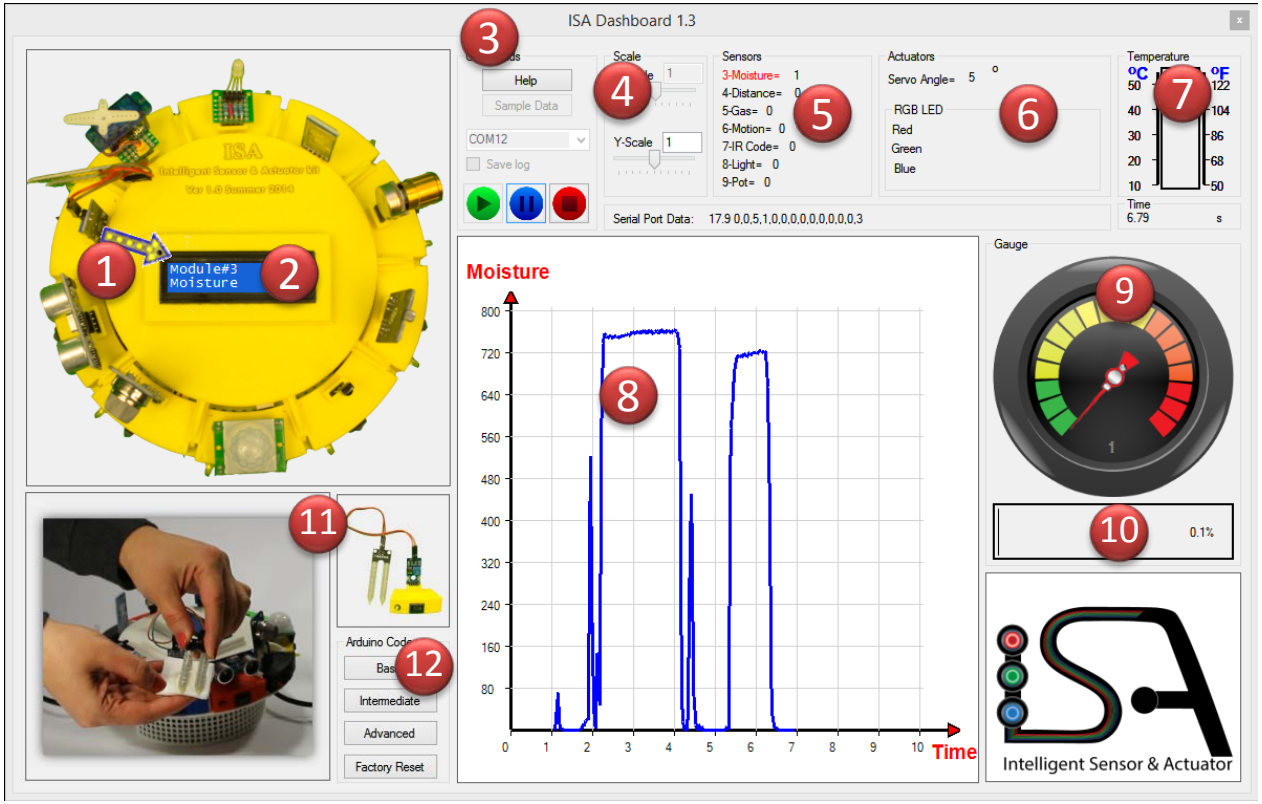
ISA Dashboard



1. Animated arrow showing the signal received from sensor or the signal sent to an actuator.
2. Information of the current module being processed.
3. Command buttons:
   - Help: Opens the user manual.
   - Sample Data: Runs a sample data file
   - COM port menu: select the COM port (USB port) that is used for connecting the ISA Kit.

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ISA Dashboard (Cont'd)

- Save log: When checked, the data log will be saved.
- Start: Starts receiving data from the ISA Kit via USB cable.
- Pause: Pauses receiving data from the ISA Kit.
- Stop: Stops receiving data from the ISA Kit.

4. Changes the scale of the y axis.
5. Date received from the sensors.
6. Date sent to the actuators.
7. Temperature data (not available in the current version. Will be activated only if the temperature sensor is connected.)
8. Plots data signals from the sensors versus time.
9. A radial gauge.
10. A bar gauge.
11. Image of the selected module being processed.
12. Opens the corresponding Arduino code (for basic, intermediate, and advanced projects). When you upload an Arduino code for basic or intermediate project, the Arduino code will not communicate with the ISA Dashboard. Only for the advanced projects the communication is enabled via the USB port.
    - Factory Reset: Opens the Arduino code that was originally uploaded on the ISA Kit when the package was delivered.

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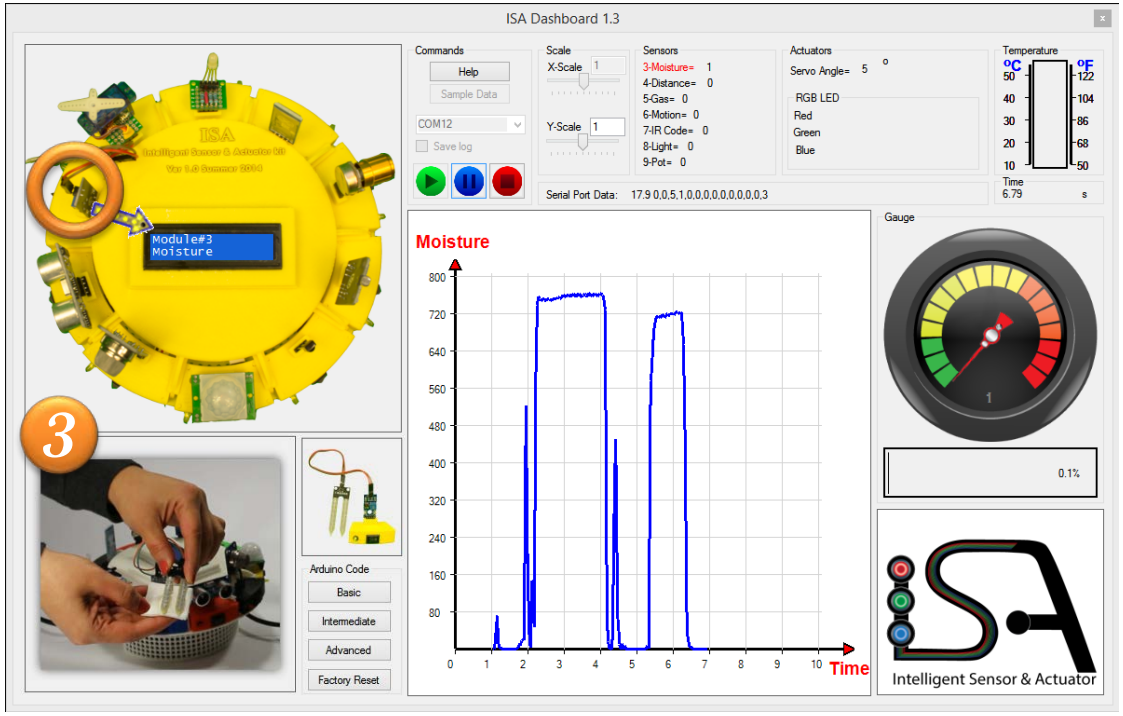
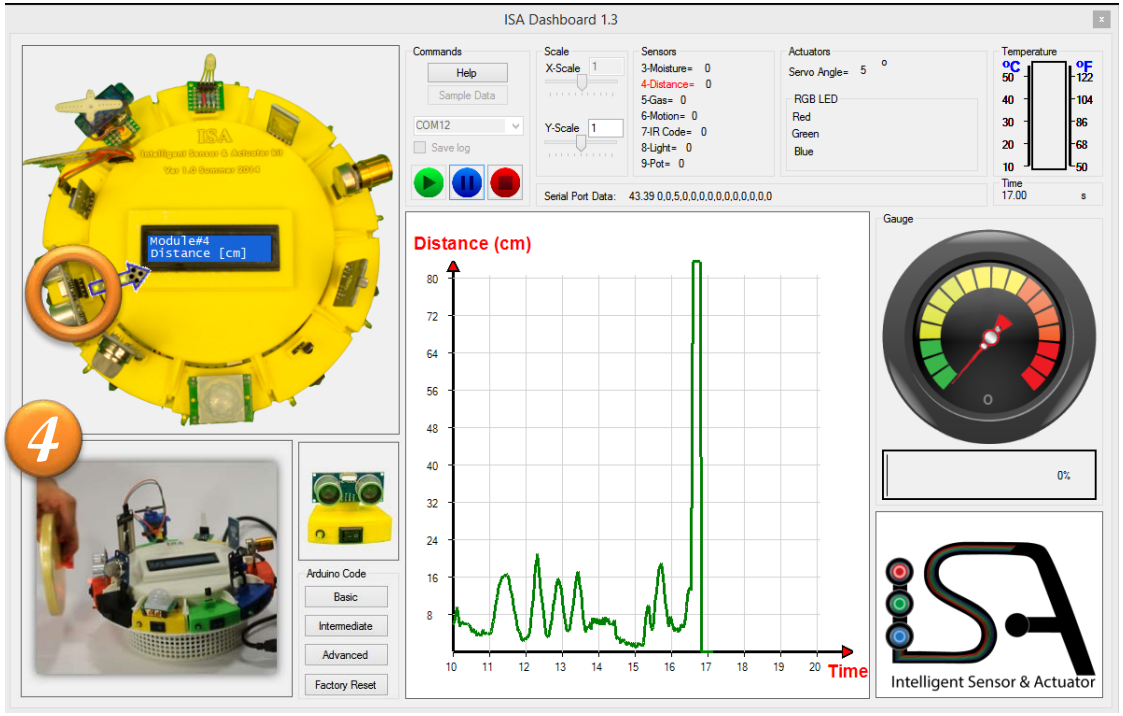
Module #3: Moisture Sensor

1. Turn all the switches off.
2. Turn on the switch for module box #3.
3. An animated arrow will show signals are being received from the moisture sensor.
4. Measure the moisture of the soil or a wet napkin/cloth. You may also measure the conductivity of your skin by holding the probe of the sensor in you hand and pressing it.
5. The data will be plotted versus time.



Module #4: Ultrasonic Sensor

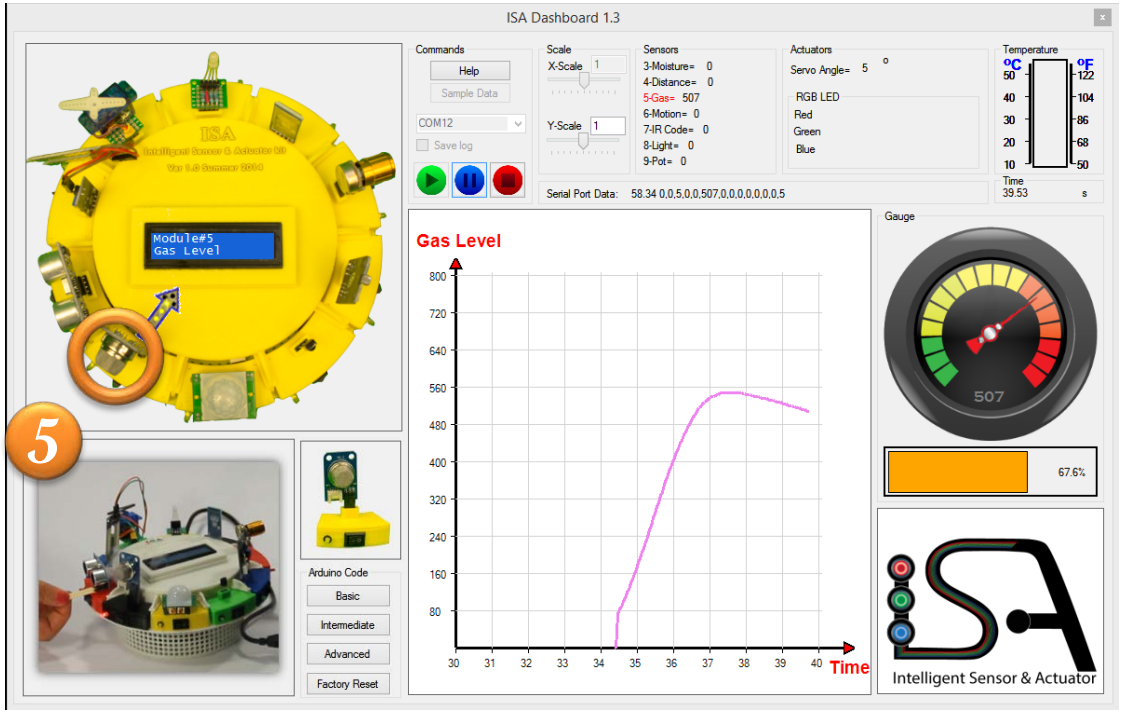
1. Turn all the switches off.
2. Turn on the switch for module box #4.
3. An animated arrow will show signals are being received from the ultrasonic sensor.
4. Move an object backward and forward in front of the ultrasonic sensor.
5. The data will be plotted versus time.



Module #5: Gas/Alcohol Sensor

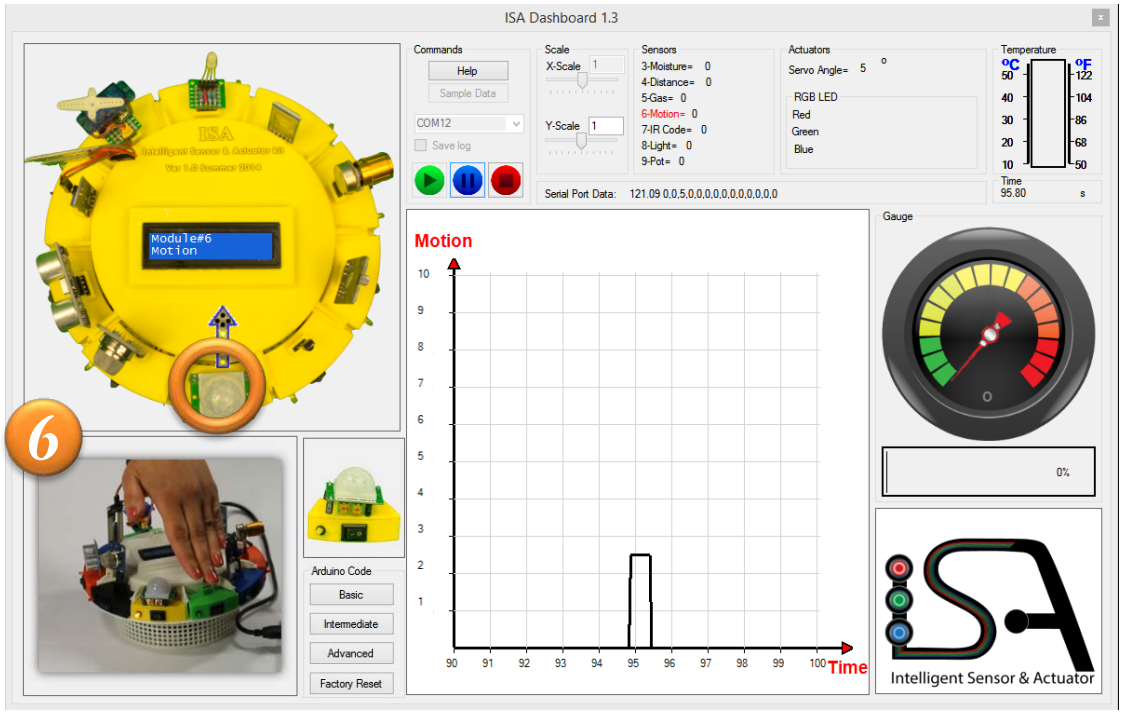
1. Turn all the switches off.
2. Turn on the switch for module box #5.
3. An animated arrow will show signals are being received from the gas/alcohol sensor. Wait for approximately 20 seconds while the sensor calibrates itself.
4. Use smoke from a match or alcohol swab in front of the sensor.
5. The data will be plotted versus time.

OR



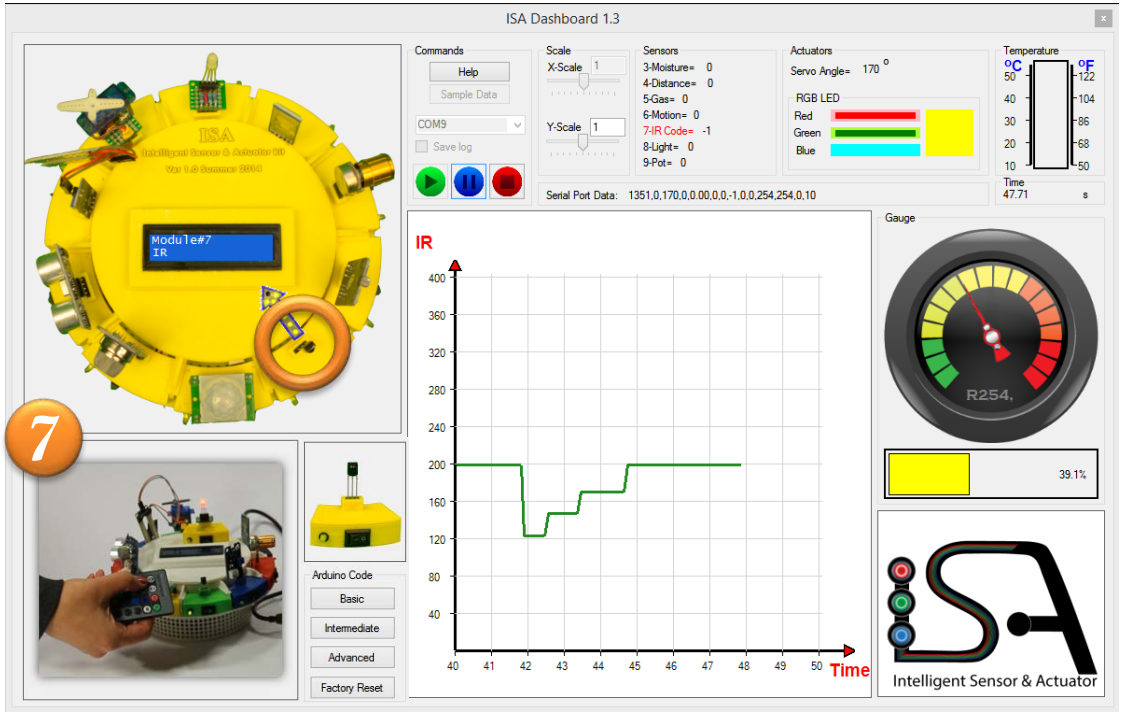
Module #6: Motion Sensor

1. Turn all the switches off.
2. Turn on the switch for module box #6.
3. An animated arrow will show signals are being received from the motion sensor.
4. Wait for a few seconds then move your hand.
5. The motion detection data will be plotted versus time (0: no motion detected, 1: motion detected).
6. One way to test the sensor is to put a Styrofoam or opaque plastic cup with a small hole in it on top of the motion sensor. Any motion close to the hole will be detected.



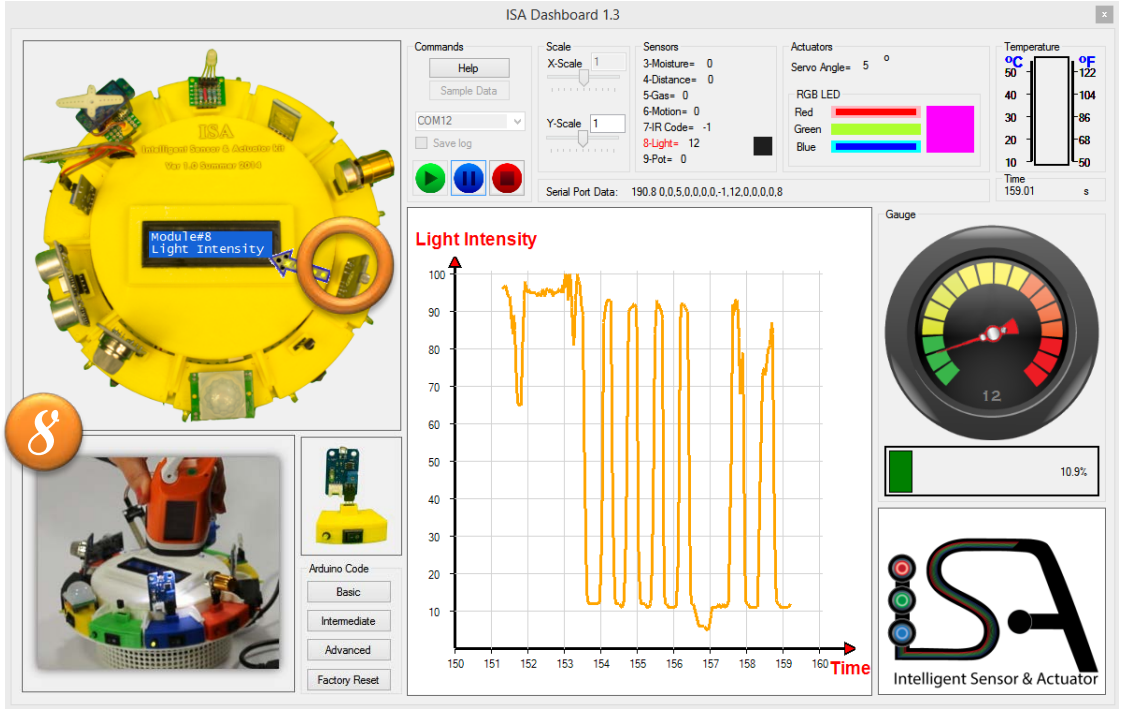
Module #7: Infrared (IR) Sensor

1. Turn all the switches off.
2. Turn on the switches for module box #7 and #1 (RGB LED).
3. An animated arrow will show signals are being received from the IR sensor.
4. Push the buttons on the IR remote control. The LED color will change accordingly.
5. The data will be plotted versus time.



Module #8: Light Sensor

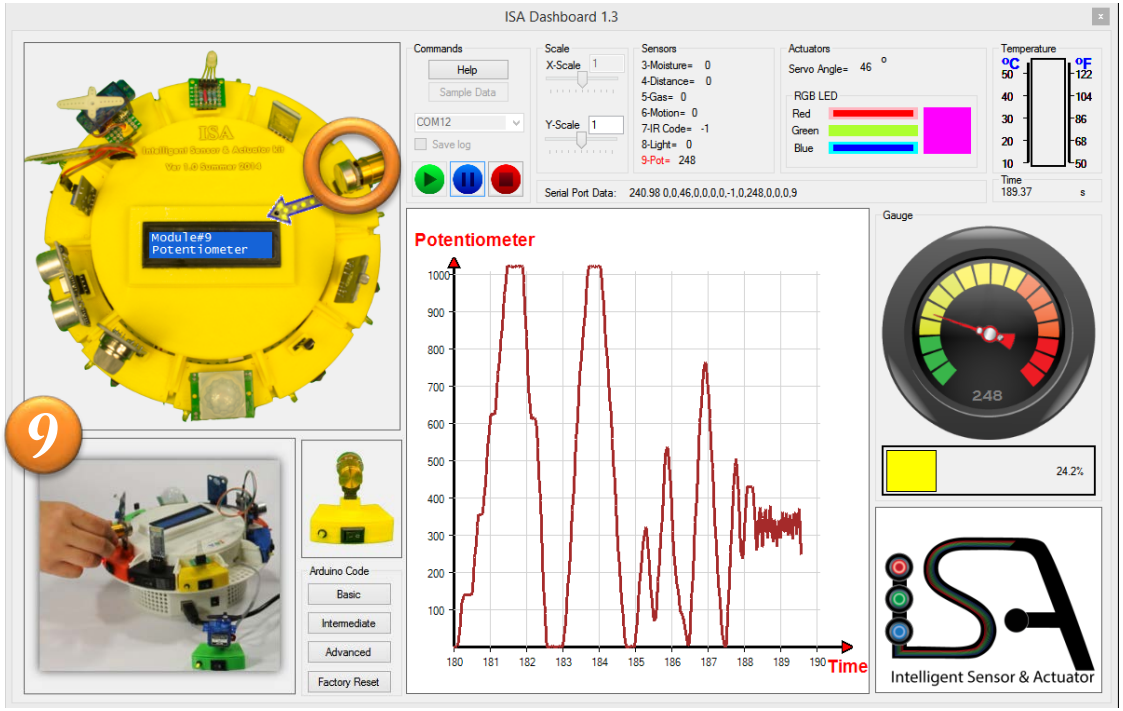
1. Turn all the switches off.
2. Turn on the switch for module box #8.
3. An animated arrow will show signals are being received from the light sensor.
4. Change the light intensity using a flash light.
5. The data will be plotted versus time.



Module #9: Potentiometer

1. Turn all the switches off.
2. Turn on the switch for module box #9.
3. An animated arrow will show signals are being received from the potentiometer.
4. Turn the knob on potentiometer.
5. The data will be plotted versus time.

Important: If you would like to control the servomotor (module #2) you should turn it on before running the ISA Dashboard.



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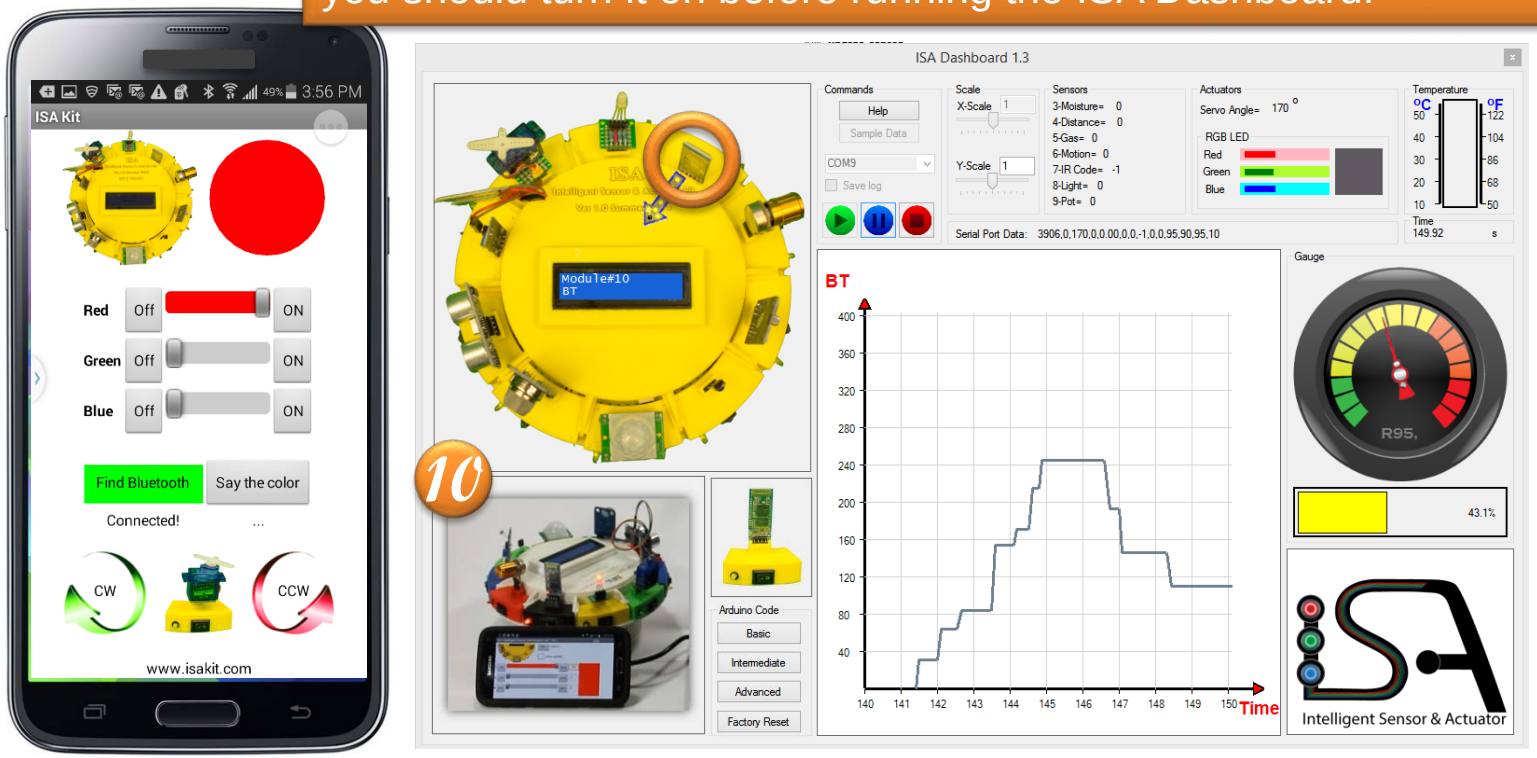
Module #10: Bluetooth

1. Turn all the switches off.
2. Turn on the switch for module box #10.
3. An animated arrow will show signals are being received from the Bluetooth.
4. Run ISA App on your smart phone or tablet.
5. The RGB color will change accordingly.

Important: If you would like to control the servomotor (module #2) you should turn it on before running the ISA Dashboard.



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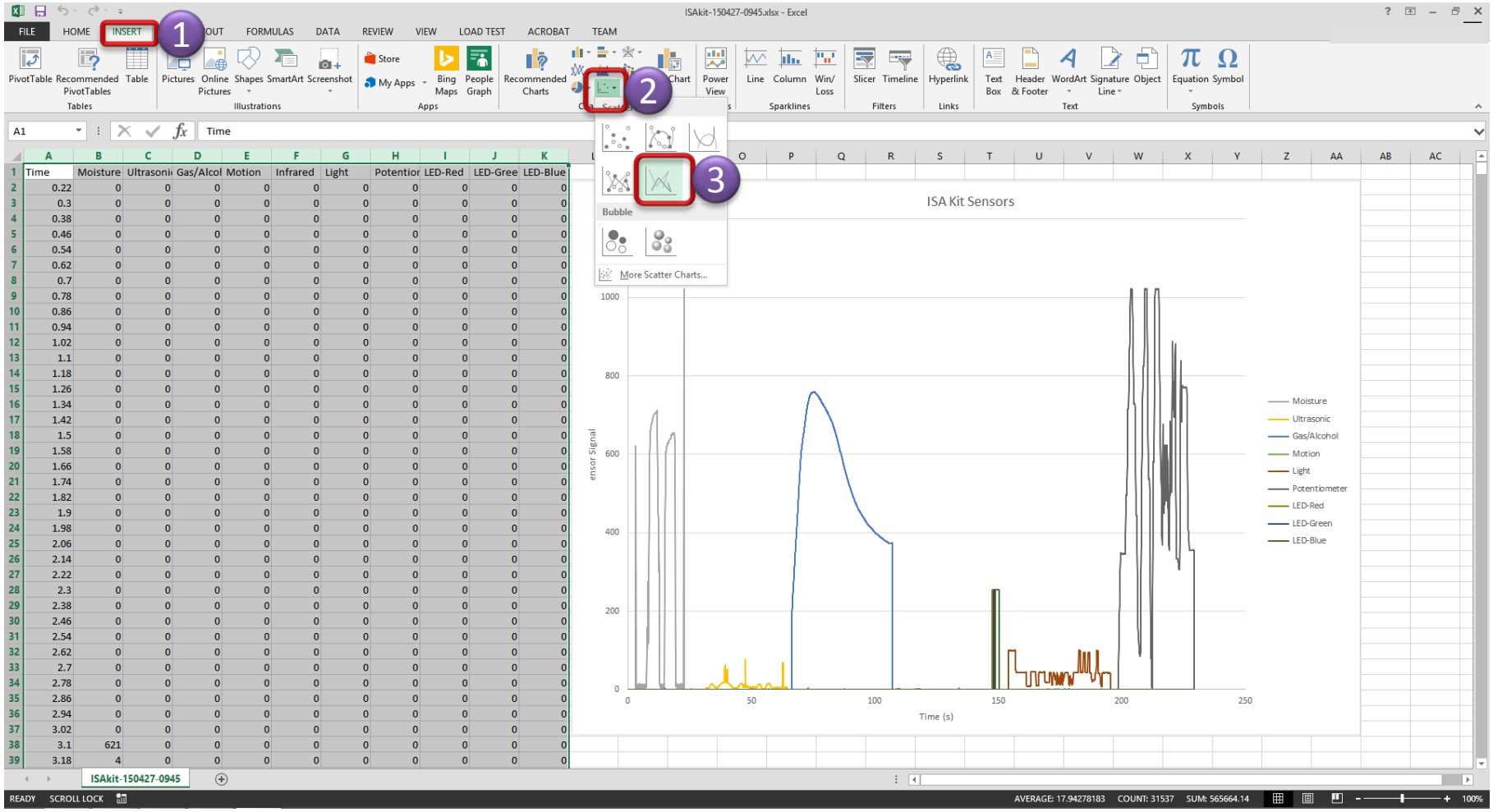
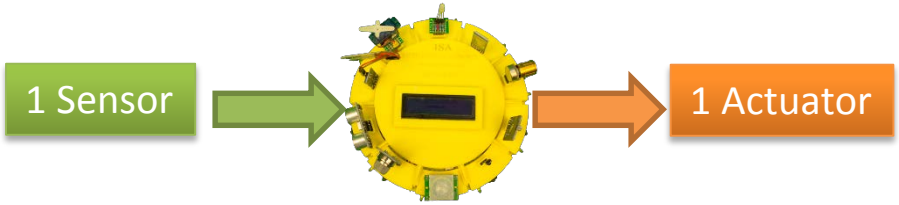
ISA Log File

When you open the saved log file in Excel, you can plot the time history of the signals received. To do so, select the data then from “INSERT” tab click on “Insert Scatter (x,y)” and finally click on your desired plot type.

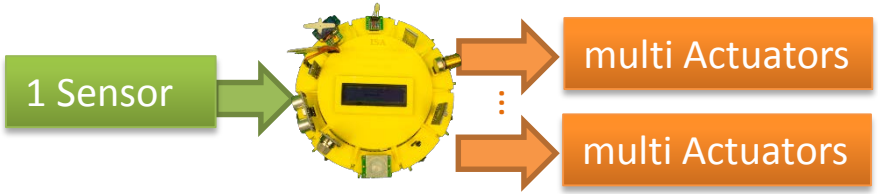


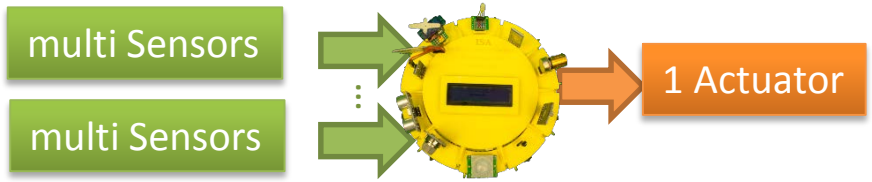
ISA Projects

Basic projects (type 1): Single-Input Single-Output (SISO)

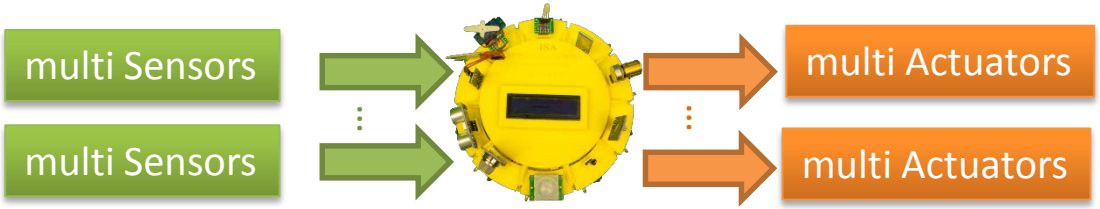


Intermediate projects (type 2): Single-Input Multi-Output (SIMO) or Multi-Input Single-Output (MISO)





Advanced projects (type 3): Multi-Input Multi-Output (MIMO)



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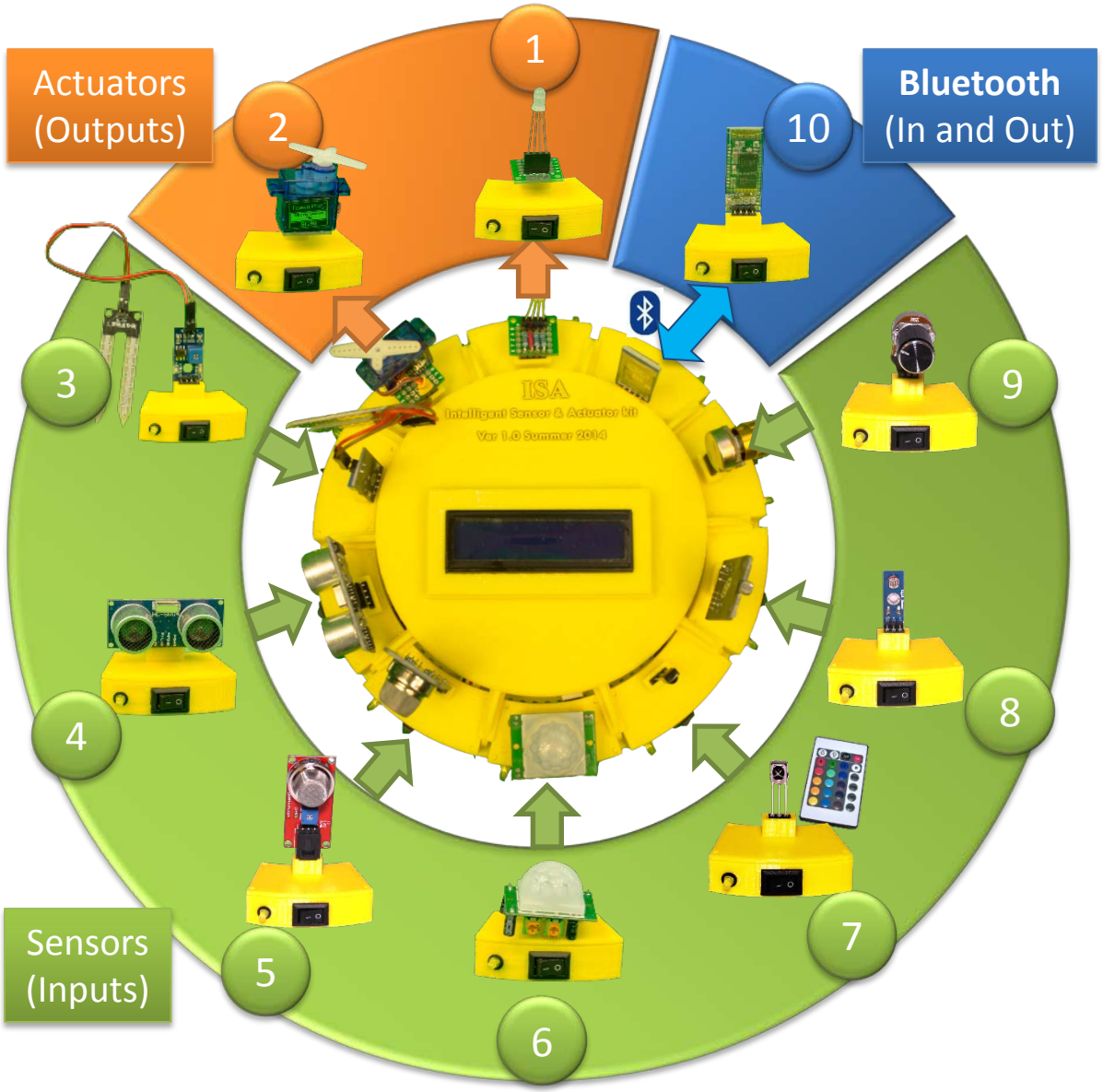
Sensors/Inputs and Actuators/Outputs



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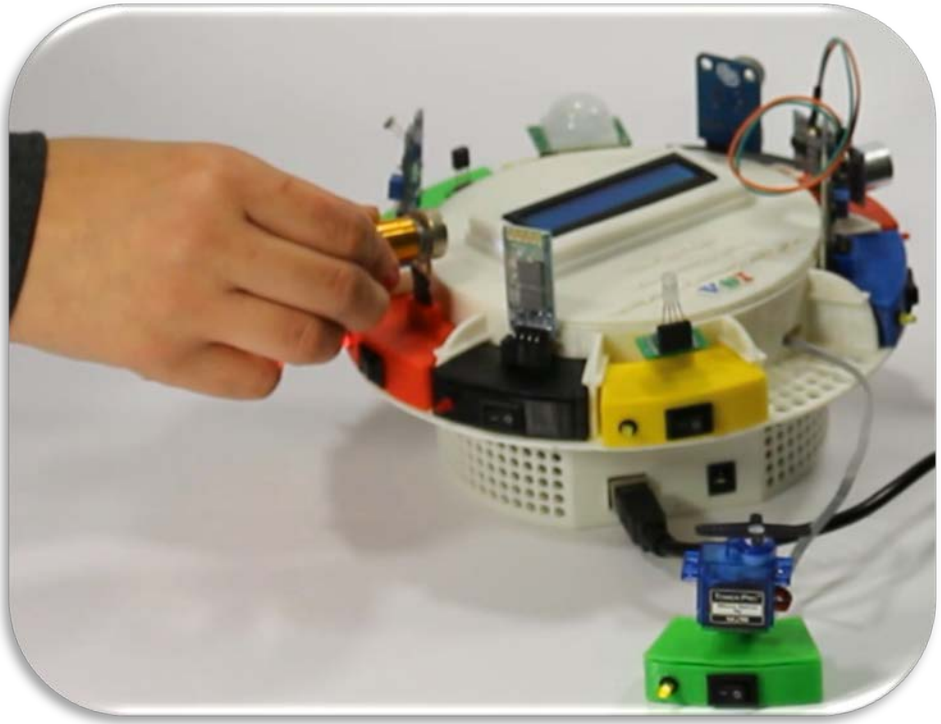
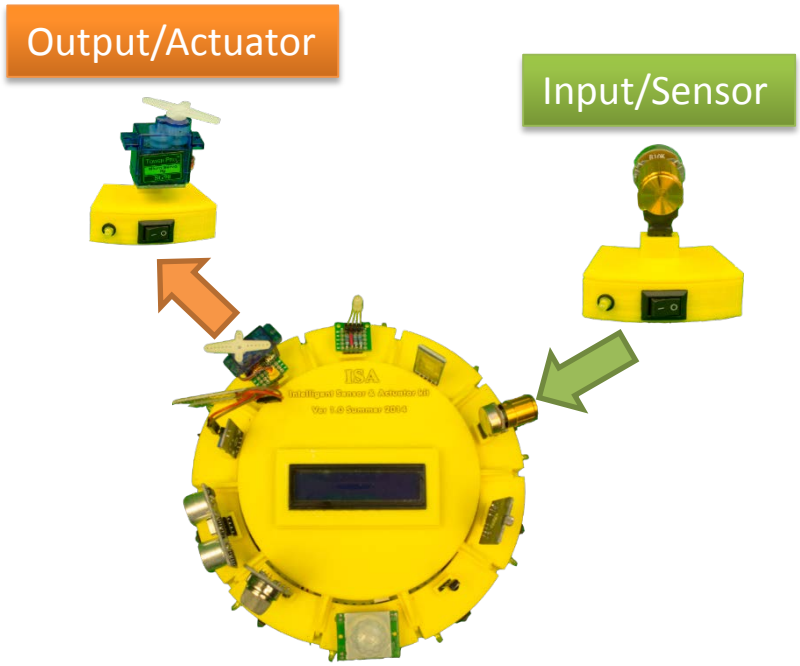
SISO Projects

ISA Kit ver 1.0 is ideal for Single Input, Single Output (SISO) projects. An example of a SISO project is a potentiometer (sensor/input) and a servo motor (actuator/output).





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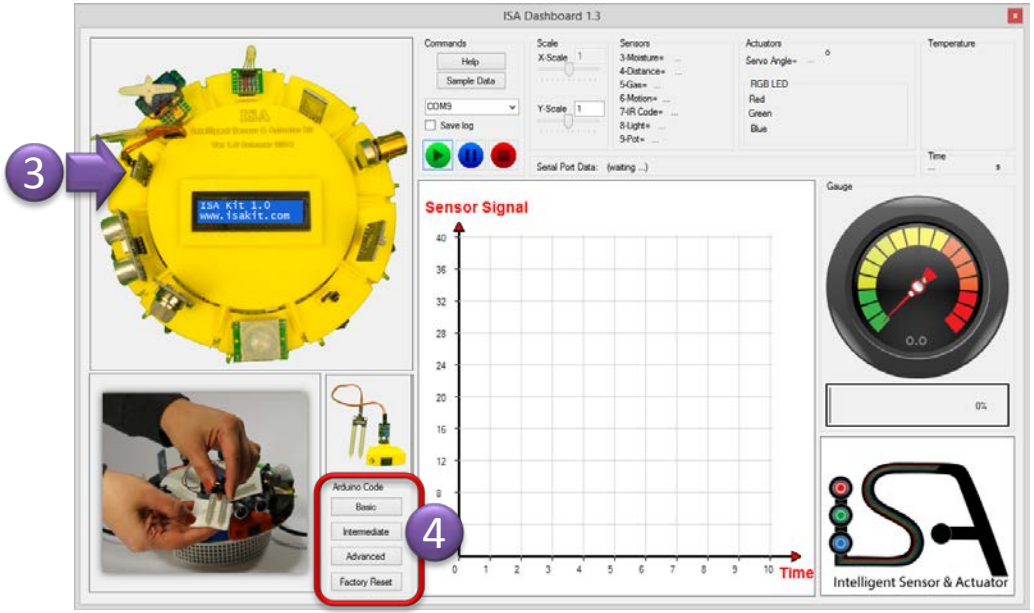
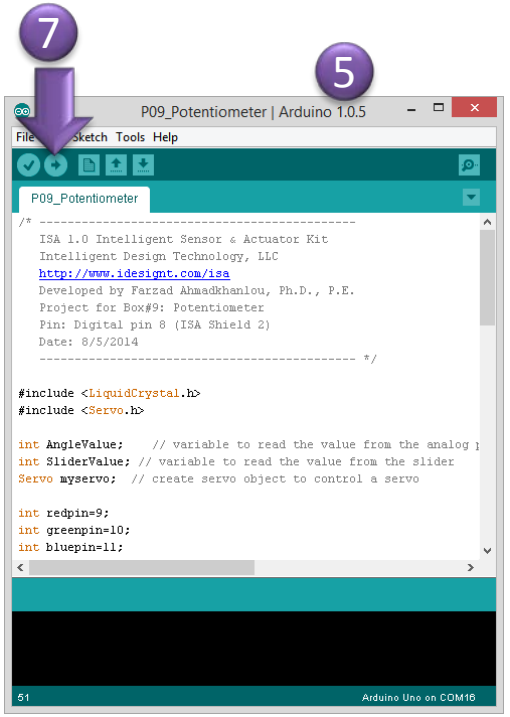
How to Run a SISO Project

1. Connect the ISA Kit to your computer through USB cable
2. Run the ISA Dashboard.
3. Pick a sensor (input) or actuator (output) by clicking on its image.
4. In the “Arduino Code” panel, select the difficulty level of the project: Basic, Intermediate, and Advanced.
5. The Arduino code for the selected project will pop up in Arduino IDE.
6. Make sure all the sensors/actuators are switched off. It is okay to leave RGB LED (module #1) on.
7. Compile and upload the code by clicking on icon.
8. Use the sensor (input) and look at the actuator (output).





Arduino Codes

- When you compile and upload the code to Arduino it will overwrite the original file on the Arduino.
- When you upload an Arduino code for basic or intermediate project, the Arduino code will not communicate with the ISA Dashboard. Only for the advanced projects the communication is enabled via the USB port. So for basic and intermediate projects the sensor/actuator signals will not be plotted in ISA Dashboard.
- For basic projects, the LCD will be disabled. To see the sensor/actuator signals use “Serial Monitor” in Arduino IDE.
- After the Arduino code for a selected sensor/actuator is uploaded to the microcontroller, only the signal received/sent from/to that specific sensor/actuator will be monitored. So the signals from the rest of sensors/actuators will not be monitored. To get signals from all the sensors/actuators you need to click on “Factory Reset” button.
- “Factory Reset” button opens the Arduino code that was originally uploaded to the ISA Kit when the package was delivered. So to reset the configuration of the ISA Kit to its original status click on “Factory Reset” button and upload the Arduino code to the ISA Kit microcontroller.

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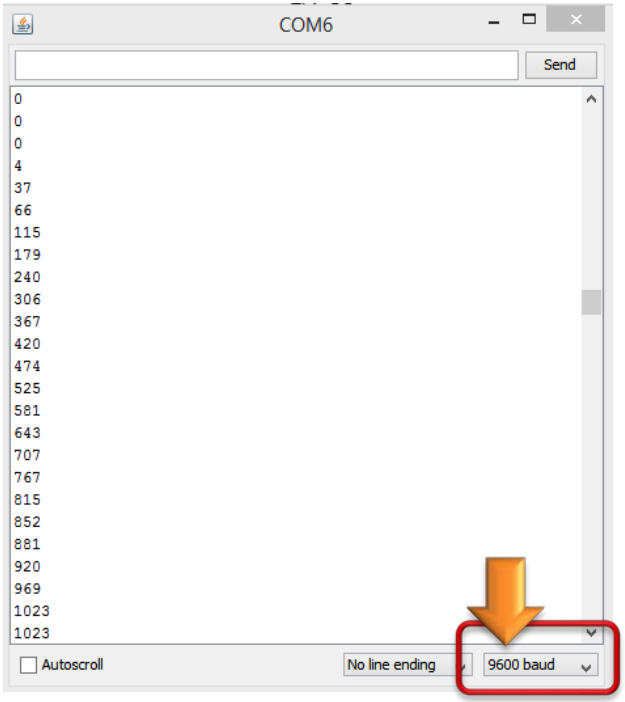
Serial Monitor

- “Serial Monitor” can be used to see the data transferred via USB port (COM or Serial port).
- After compiling the code to Arduino microcontroller, click on “Serial Monitor” to see the data.
- The baud rate value in “Serial Monitor” window should be the same as the baud rate used in the code. The default value is 9600.

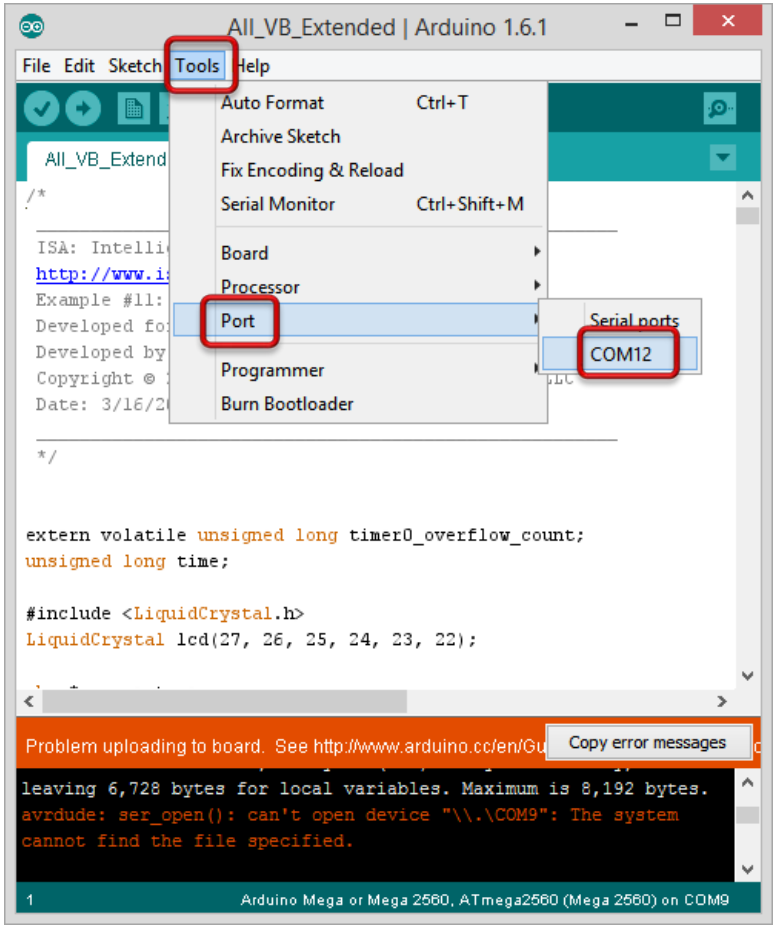
Serial Monitor



Arduino IDE Troubleshooting

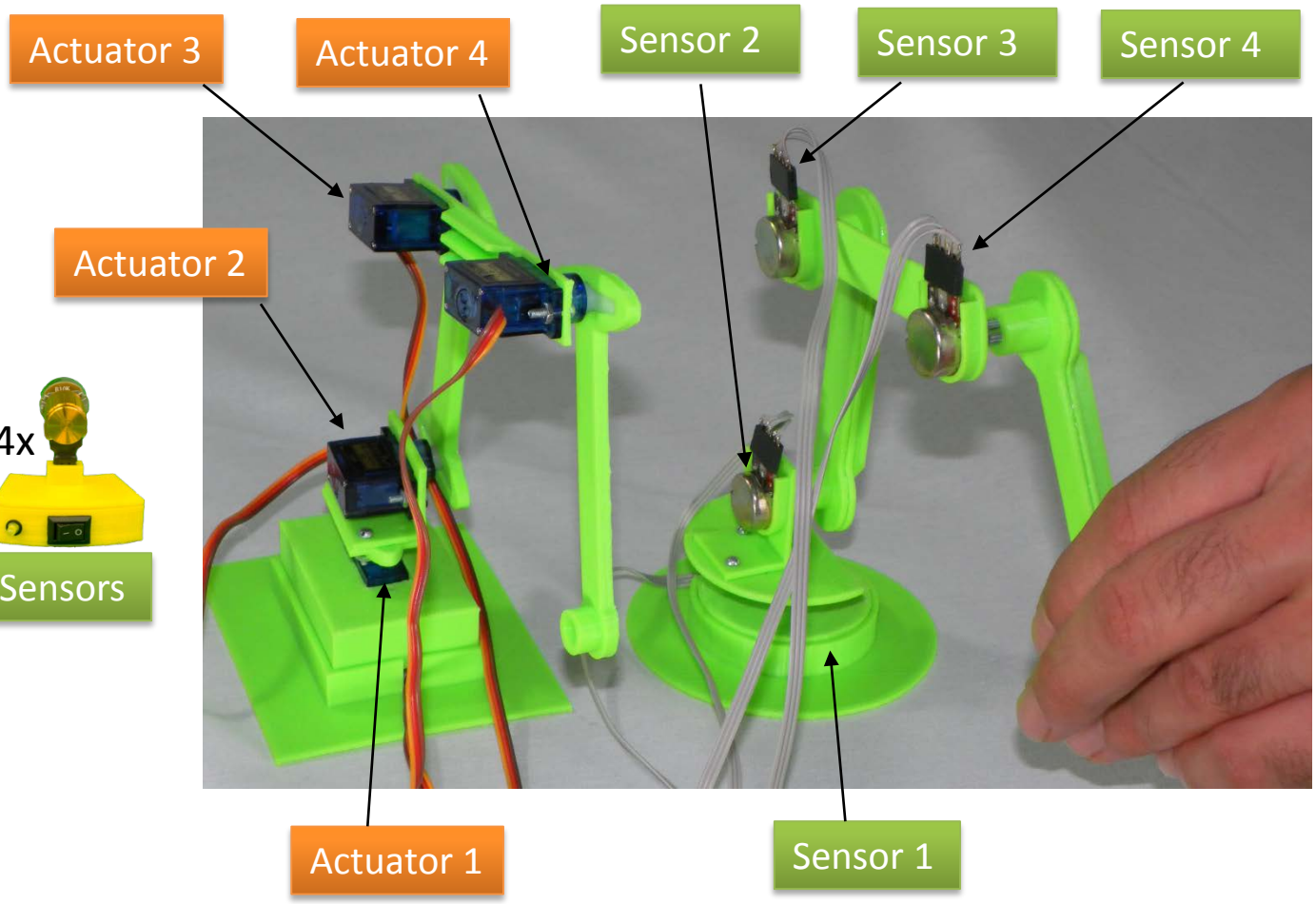
If an error message appears during uploading the code to Arduino, you may need to do one of the following actions:

- Turn all the switches off (from module #1 to #10).
- Check the USB port connection
- Select the correct COM port number. This COM port number varies for different computers.
- Unplug the ISA Kit from your computer and plug it back.
- Reboot your system.



MIMO Projects

You can do Multi-Input, Multi-Output (MIMO) projects with the ISA Kit ver 1.0. An example of a MIMO project is a four degree-of-freedom (DOF) tele-robotic arm. In this project, four potentiometers (sensors/inputs) and four servo motors (actuators/outputs) are used.



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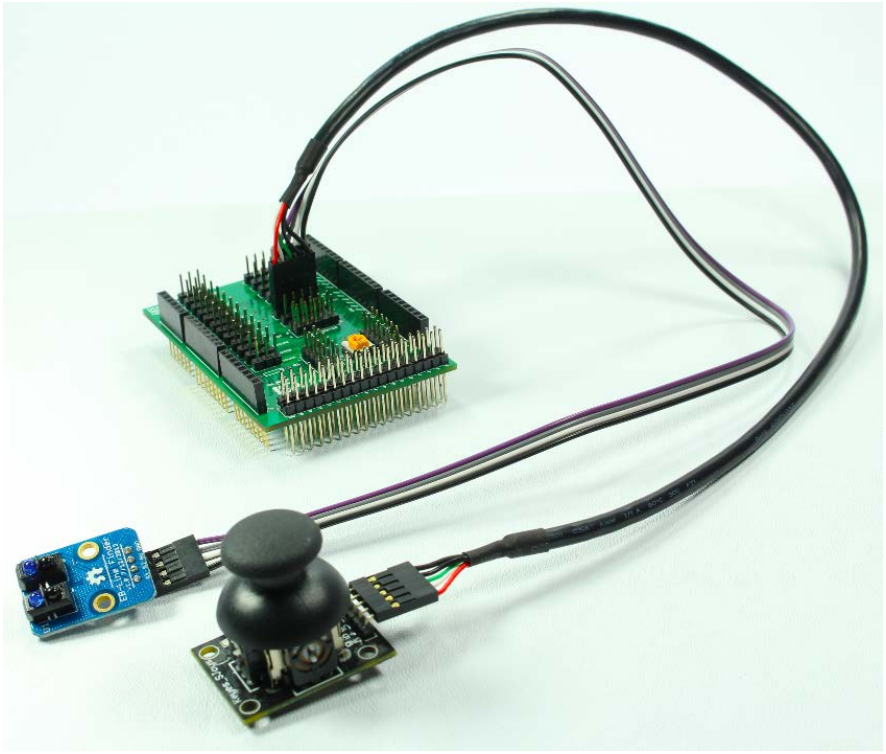
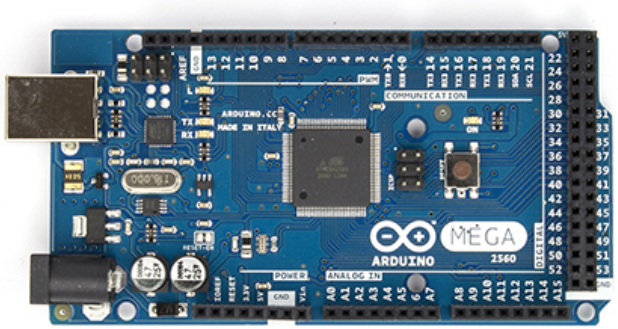
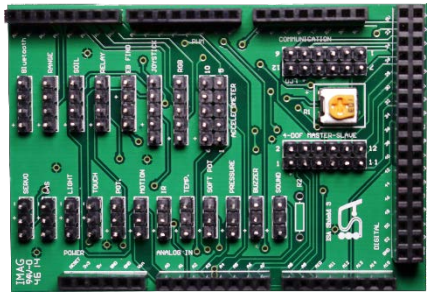
ISA Shield

ISA Shield is a Printed Circuit Board (PCB) interface between the Arduino microcontroller and sensors and actuators. ISA Shield 2 was designed for Arduino UNO and ISA Shield 3 is designed for Arduino Mega which comes with the ISA Kit 1.0. This shield is designed such that you can easily plug in your sensors and actuators.



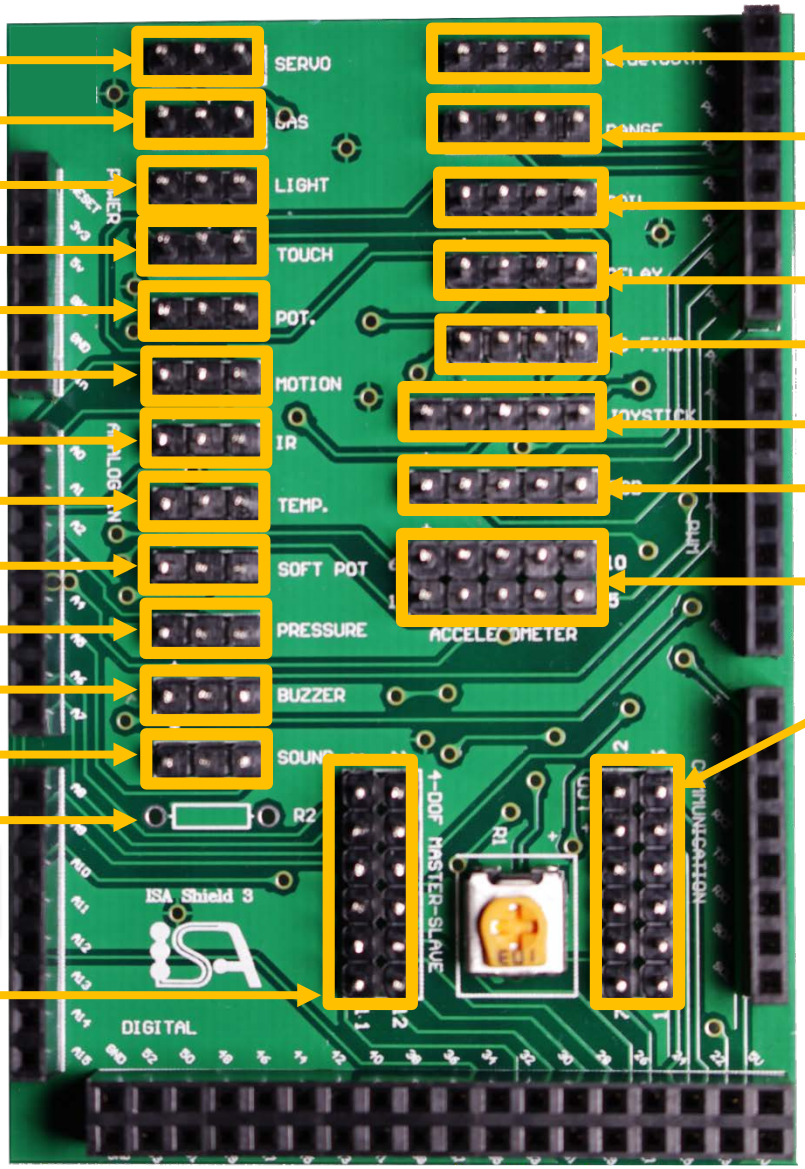


Arduino Mega



ISA Shield 3

ISA Shield 3



Servomotor

Gas/alcohol

Light

Touch

Potentiometer

Motion

Infrared (IR)

Temperature/humidity

Soft Potentiometer

Pressure

Buzzer

Sound

Pressure Resistor

Solder a resistor that is appropriate for your pressure sensor.

4-DOF tele-robotic arm

Bluetooth

Ultrasonic (range)

Moisture sensor

Relay

Find Line (Tracking)

Joystick

RGB LED

Accelerometer

LCD

Sensors/actuators marked in red are part of the extended features for ISA Kit 1.0.

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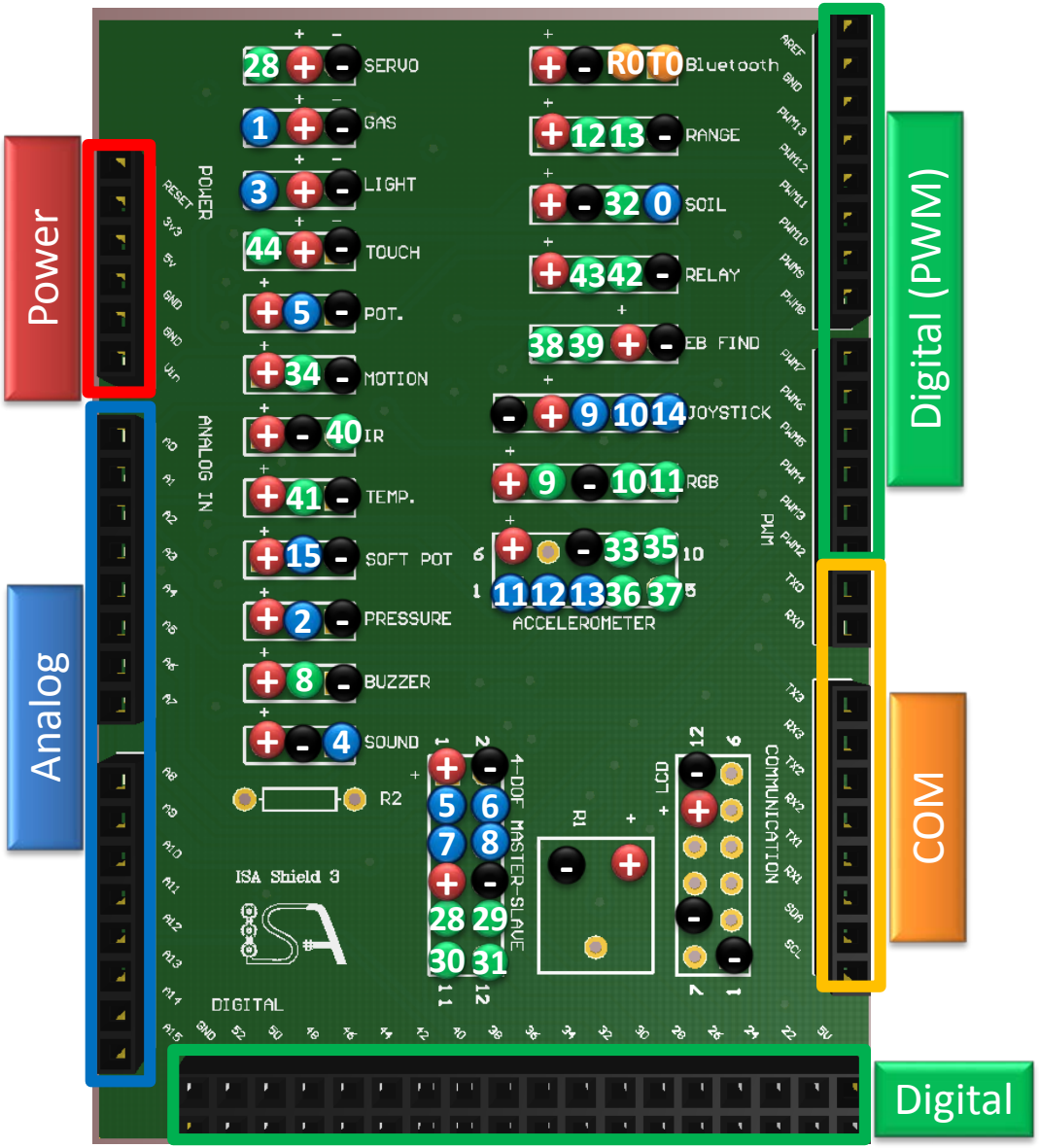
ISA Shield 3 (pins)

For intermediate and advanced projects

- + +5V
- - Ground
- D Digital pin #D
- A Analog pin #A
- C COM pin #C



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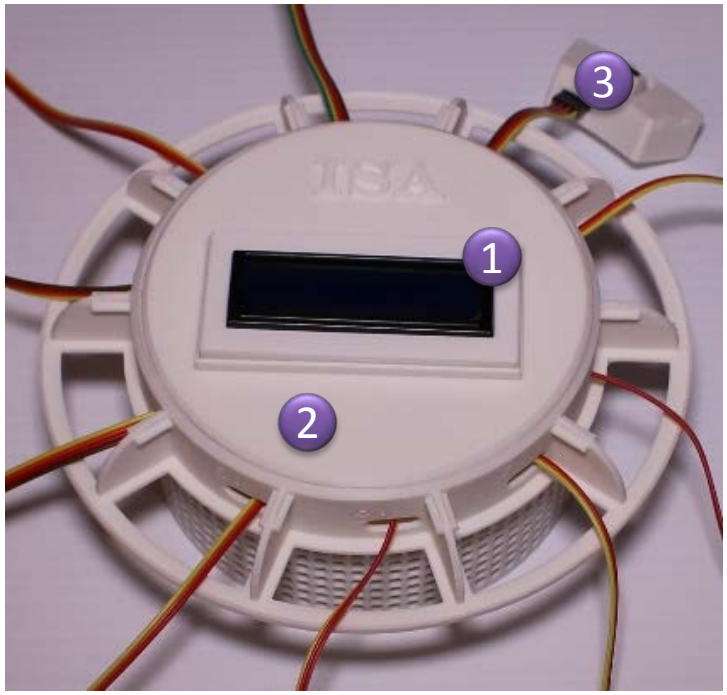
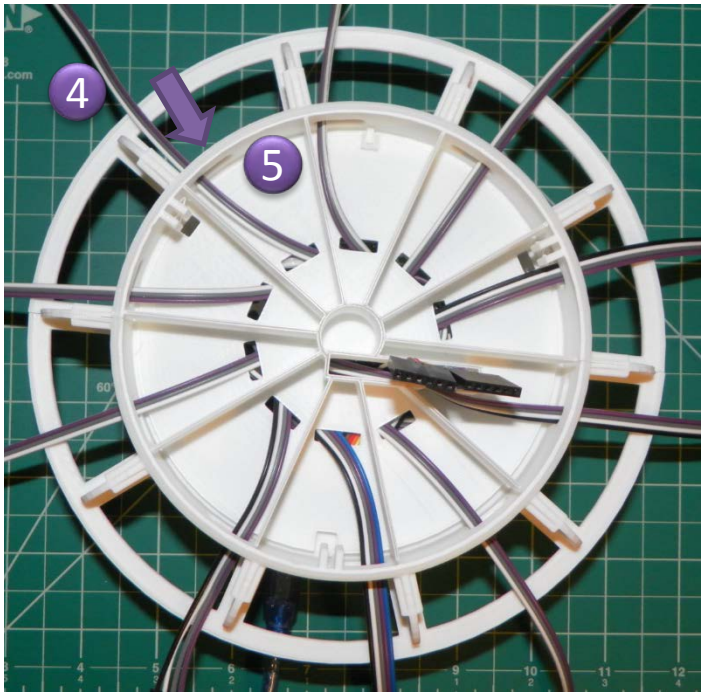
How to Access the ISA Shield

The ISA Kit is designed such that you can disassemble and reassemble it back fast. In order to access the ISA Shield you need to follow these steps:

1. Remove the LCD lid and then unplug the LCD
2. Remove the top lid
3. Unplug all the wires from the sensor boxes
4. Push all the wires inside the middle wire compartment
5. Remove the middle wire compartment





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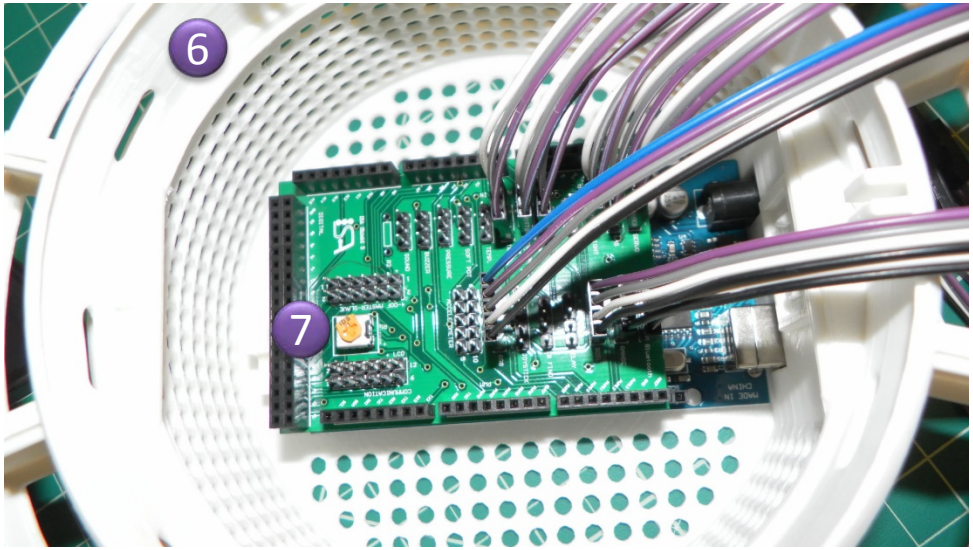
How to Access the ISA Shield (Cont'd)

6. This is how you see the ISA Shield 3 inside the ISA Kit.
7. A potentiometer is placed on the ISA Shield that can be used to change and adjust the LCD contrast.
8. An extra opening is considered on the housing for the projects that you need to use extra wires for additional sensors/actuators. To use it, push it gently from inside and the cap will pop out.



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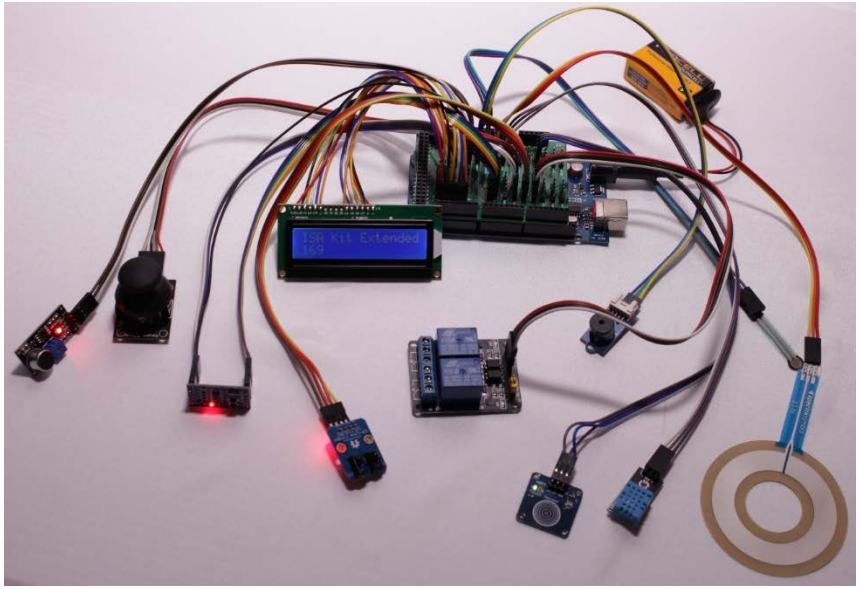
Additional Sensors/Actuators

The ISA Shield 3 is designed such that you can easily add different types of sensors and actuators and customize it based on the needs of your projects. Some of these extra sensors/actuators are temperature and humidity sensor, 3-axes accelerometer, touch sensor, pressure sensor, sound sensor, 2-D joystick, buzzer, and relay.

2D Joystick	Sound	Touch	Pressure	Soft Pot	Track	3-axes Accelerometer	Temperature and Humidity	2-Channel Relay	Buzzer



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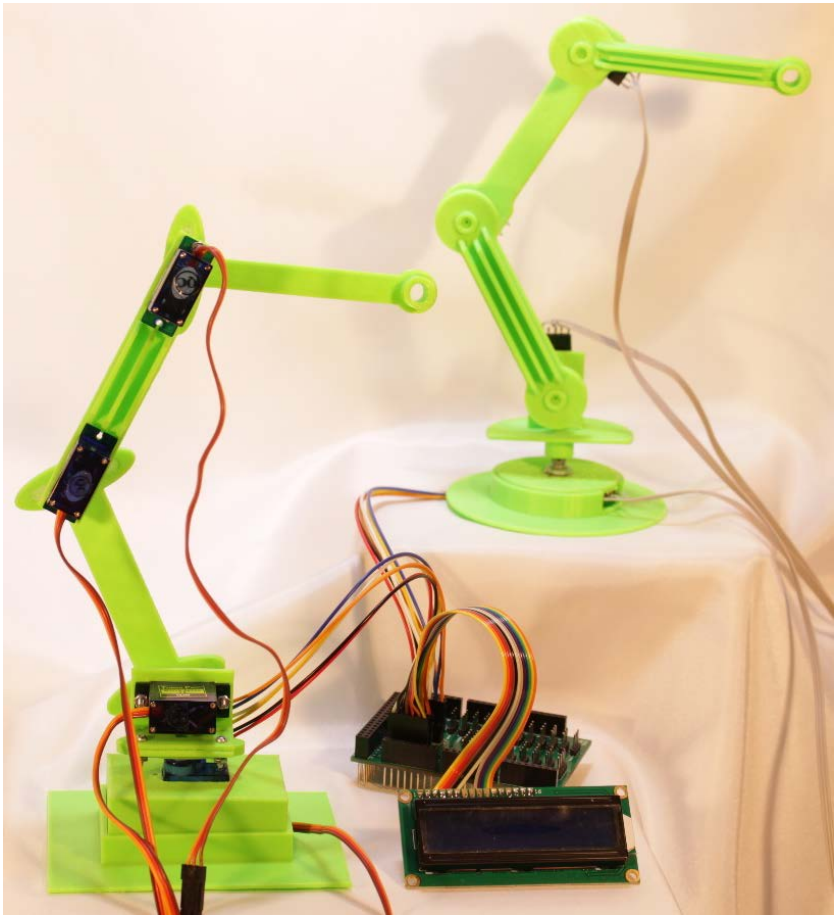
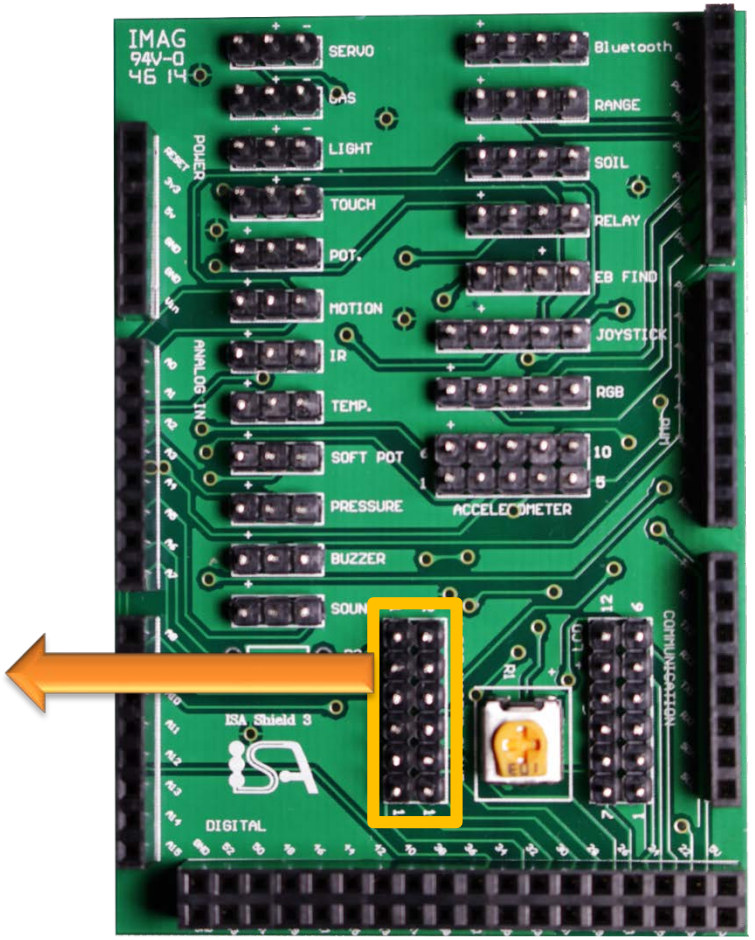
Add On: 4 DOF Telerobotic Arm

In this MIMO project, four potentiometers (sensors/inputs) and four servo motors (actuators/outputs) are used. The connection is already available on the ISA Shied 3.





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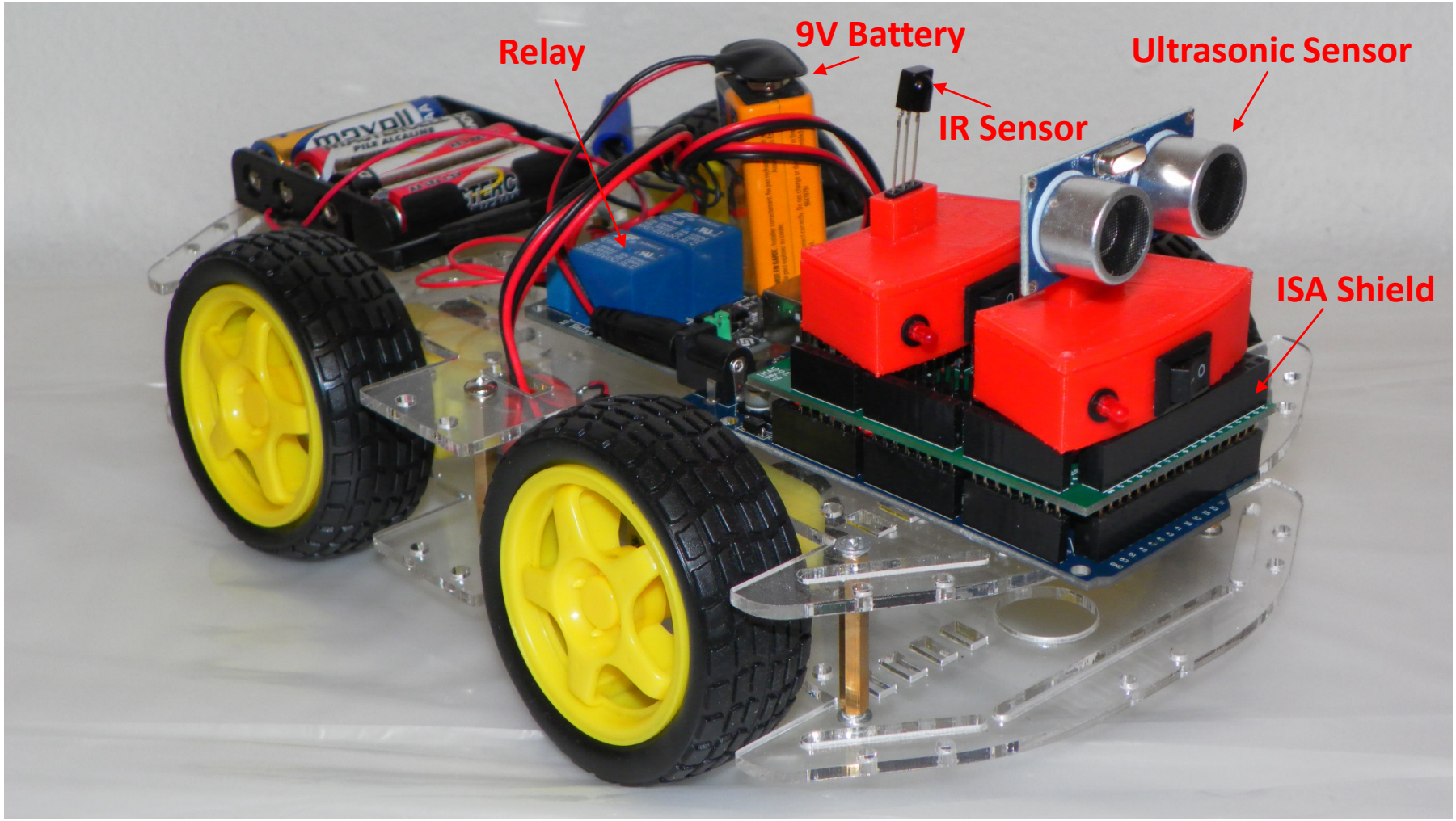
Add On: Remote Control Car



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ISA Kit Projects

	# of Sensors/Inputs	# of Actuators/Outputs	# of SISO Projects	# of MIMO Projects
Basic	8	5	40	7,865
Pro (Extended)	15	8	120	8,355,465

			Sensors/Inputs								Extended Sensors							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	15
			Moisture	Ultrasonic	Gas/Alcohol	Motion	Infra Red (IR)	Light	Potentiometer	Bluetooth	Joystick	Sound	Touch	Pressure	Soft Pot	Track	Accelerometer	Temperature
Actuators/Outputs	A	RGB LED		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A15
	B	Servo		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B15
	C	LCD		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C15
	D	Serial Monitor		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D15
	E	Bluetooth		E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E15
Extended Actuators	F	LED		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F15
	G	Relay		G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	G15
	H	Buzzer		H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H11	H12	H13	H14	H15	H15

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ISA Kit SISO Project

1. Pick a sensor (input) → "#7:Potentiometer" in this example
2. Pick an actuator (output) → "B:Servo" in this example
3. Click on the corresponding project name → "B7" in this example

			Sensors/Inputs							
			1	2	3	4	5	6	7	8
			Moisture	Ultrasonic	Gas/Alcohol	Motion	Infra Red (IR)	Light	Potentiometer	Bluetooth
Actuators/Output	A	RGB LED	A1	A2	A3	A4	A5	A6	A7	A8
	B	Servo	B1	B2	B3	B4	B5	B6	B7	
	C	LCD	C1	C2	C3	C4	C5	C6	C7	
	D	Serial Monitor	D1	D2	D3	D4	D5	D6	D7	D8
	E	Bluetooth	E1	E2	E3	E4	E5	E6	E7	E8

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Links

ISA Kit website: http://www.isakit.com

Intelligent Design Technology LLC: http://www.idesignt.com

The Henry Samueli School of Engineering at the University of California, Irvine: http://www.eng.uci.edu/

Intelligent Structures and Systems Lab (ISSL): http://issl.eng.uci.edu/

Sensors and actuators of the ISA kit (YouTube): https://www.youtube.com/watch?v=GMSeic3EwSc

Arduino: http://www.arduino.cc/

Email: info@isakit.com

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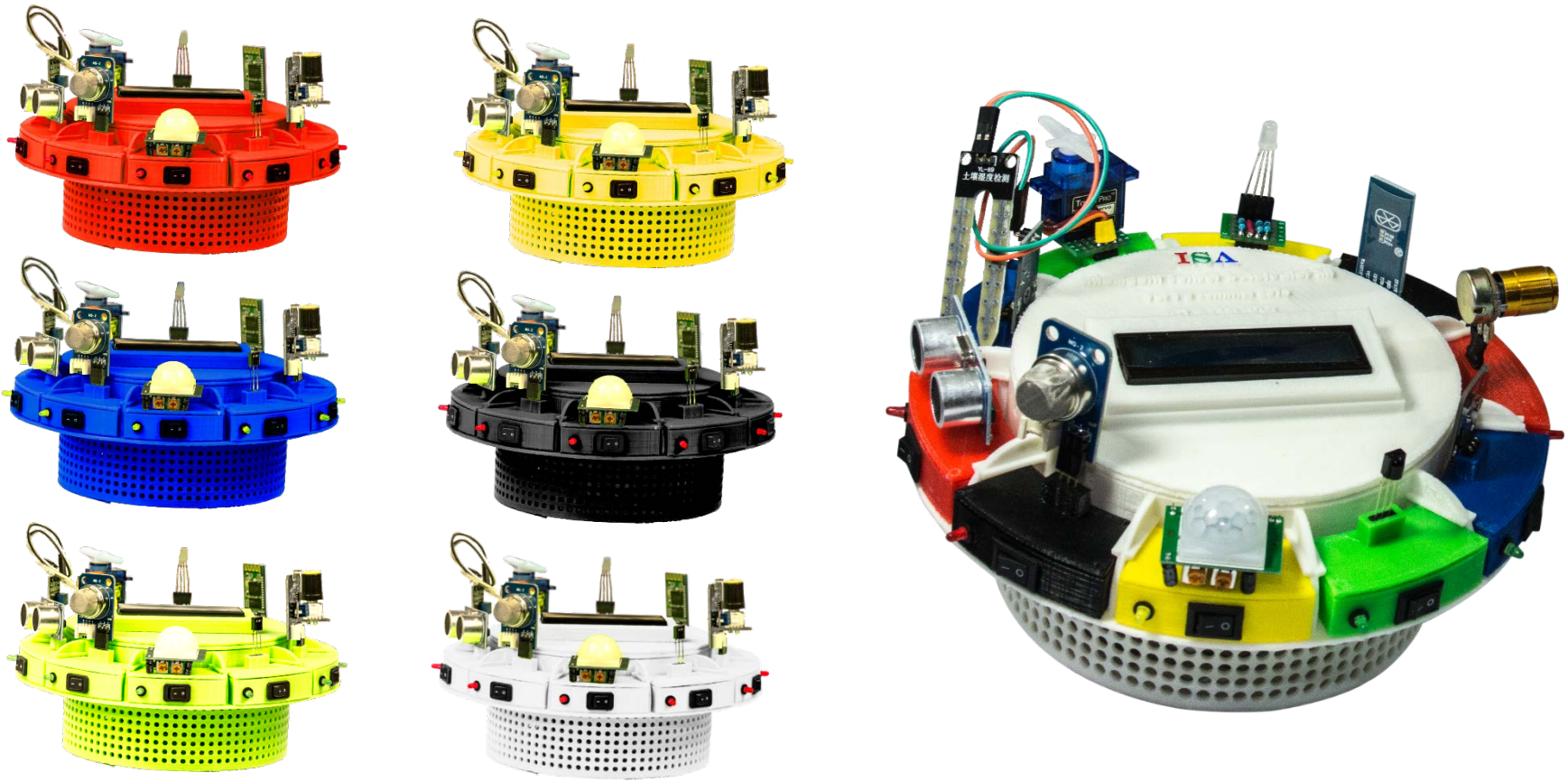

Google play

ARDUINO

MADE IN U.S.A PRODUCT